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ABSTRACT

This teacher-oriented learning module for secondary level consumer education teachers, the last in a series of three, was developed to provide information on the metric system and ideas for conveying this content to students. The module begins with a definition and general goals of consumer education, a rationale, an overview, ten module performance objectives, performance objectives over eight areas for learning the metric system by doing, and a pre-test. The next portion of the module covers the ten performance objectives and for each one (varying from one to three pages in length) includes content correlated with student learning activities. The areas of content covered include the following: history of the metric system, why the metric system should be used, and how metrics will affect our daily lives. The module then focuses on learning metrics by doing, and includes the following: an explanation of how to organize the class into eight groups, a list of supplies needed by each group, and worksheets containing learning activities for the groups. The learning activities cover eight areas, among which are mass, volume, temperature, and personal measurements. A posttest and a list of supplemental resources conclude this module. The appendix includes additional teaching materials, answer keys, and transparency masters. (EM)

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METRICS FOR THE CONSUMER

BY: EUNICE PHILLIPS

AUGUST, 1977

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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A TEACHER INSERVICE MODULE FOR SECONDARY LEVEL CONSUMER EDUCATION UNITS IN HOME ECONOMICS, BUSINESS EDUCATION, SOCIAL STUDIES AND RELATED AREAS.

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THE CENTER

The Michigan Consumer Education Center provides professional development and continuing education services to educators through courses, workshops, inservice programs, conferences and publications. The Center maintains a loan library of teaching-learning resources available for preview and evaluation.

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CE 019 048

METRICS FOR THE CONSUMER

TABLE OF CONTENTS

Definition, Scope and Goals of Consumer Education 1

Rationale -- Metrics Module 2

Overview -- Metrics Module 3

Performance Objectives -- Metrics Module 4

Pre-Test 7

History of the Metric System Throughout the World 8

The Metric System as part of Everyday Life 11

Why Should We Use the Metric System? 13

Why We Have Not Switched to the Metric System 16

How Will Metrics Affect Our Daily Lives 17

Using the Metric System 19

Learning Metrics by Doing 24

A. Mass 27
B. Volume 29
C. Temperature 31
D. Personal Measurements 35
E. Length 37
F. Map Making 40
G. "Rule of Thumb" Conversions 42
H. Metric Tic Tac Toe 44

Post-Test 49

Supplemental Resources 51

Appendix 53

Additional Teaching Materials 54
Answer Keys 62
Transparency Masters 65

APPROXIMATE CLASSROOM TEACHING TIME:

8 to 10 50-minute class periods

DEFINITION AND SCOPE

Consumer education is the preparation of individuals in the skills, concepts and understandings required for everyday living so they can achieve within the framework of their own values, maximum use and satisfaction of their resources.

Consumer education involves the study of factors affecting consumer behavior, personal financial management, buying and using goods and services, rights and responsibilities of both buyers and sellers, basic economic principles, and sources of consumer information and assistance.

GENERAL GOALS OF CONSUMER EDUCATION

CONSUMER BEHAVIOR

The student will analyze the factors affecting consumer behavior.

Values	Decision Making	Basic Skills
Goals	Advertising	Special Needs
Lifesytles	Career Choice	

FINANCIAL MANAGEMENT

The student will apply basic principles of sound financial management.

Budgets	Bankruptcy	Payroll Deductions
Credit	Tax Forms	Financial Services
Record Keeping	Estate Planning	Savings and Investments
Insurance		

GOODS AND SERVICES

The student will demonstrate knowledge and skills in buying and using goods and services.

Food	Transportation	Health
Clothing	Education	Professional Services
Housing	Recreation	

RIGHTS AND RESPONSIBILITIES

The student will analyze the interrelated rights and responsibilities of consumers, business and government.

Consumer Laws	Complaint Methods	Consumer Representation
Legal Rights	Environment	Current Issues
Energy	Product Safety	

ECONOMICS

The student will relate economic principles to the functions of the marketplace.

U. S. Economic System	Profits and Price
World Economic Systems	Supply and Demand
Government Regulation	Taxation
Inflation and Recession	Unemployment

INFORMATION AND ASSISTANCE

The student will evaluate sources of consumer information and assistance.

Federal Agencies	Private Organizations
State and Local Agencies	Information Evaluation
Community Services	

The objectives of this module relate to one or more of the general goals of consumer education.

RATIONALE

The metrics are coming! Should Paul Revere ride through our communities today, how many of us would be ready to jump in and tackle this new language of measurement? With the arrival of the metric system, the problems the consumers face every day will still be the same. Yet, it will not be quite what we are used to. Are you ready? The metric system is coming.

We have had plenty of time to get ready. The metric system has been debated in congress since 1821. Metric weights were established for the United States coinage in 1876 and in 1893 the yard and pound were defined in terms of the meter and the kilogram. Yet, over one-hundred years later the United States still has not officially adopted the metric system of measurement.

On December 23, 1975 President Gerald Ford signed the Metric Conversion Act, committing our nation to the use of metrics. This act established a national metric broad whose function it is to coordinate the increasing use of the metric system in the United States and provide for an organized manner of adopting its use.

The American consumer is probably the last to feel the change and the last to prepare for the change. We are comfortable with our present system. Most of us have no trouble visualizing a 9 ft. by 12 ft. carpet, a pound of butter, or a day in Florida at 100°F. We will have to learn to speak and understand a new language. Through experience we will learn that it is hot when it is 30°C outside, that a kilogram of hamburger is enough to feed ten people, and that a 15 foot putt is 4.6 meters.

Teachers are change agents. As teachers we can help students to feel secure in a metric system of measurement which is logical, consistent, and in step with the rest of the world. Memorizing a long list of equivalencies is not the way to go metric. We must teach our students to not only "think" metric but to "live metric" and to have fun doing so. We must learn to speak this new language fluently.

The smooth transfer of metric knowledge will be possible only if the teacher understands the system. Do not panic, it is easy. Begin practicing now. Give yourself hands-on activities. Estimate and make all measurements in metric. Purchase some metric equipment for your own use and begin living with it.

OVERVIEW

This module is designed for consumer education teachers and based on the following questions that consumers ask about metrics:

1. Why should I change to metrics?
2. What advantages does the metric system have over our customary system of measurement?
3. What am I already using that is metric?
4. How will the change to metrics affect my life?
5. What will the change to metrics cost me?
6. What are the metric units, their relative sizes, and how do they compare to the system of measurement I am now using?
7. What items are measured by each of the metric units?
8. How does the decimal system work and what do the prefixes mean?
9. How do I write the metric symbols correctly?
10. I need to be able to estimate the size of items with reasonable accuracy.
11. Is it necessary to learn a long list of conversion factors? Memorizing such a list of equivalencies is not the way to go metrics but knowing a few conversion factors to relate the old to the new may make the consumer feel more comfortable.

The module contains a history of the metric system including a map showing how the United States remains an island in a metric world. Cameras, skiis, and drug prescriptions show how the various units of metric measurement have already invaded our everyday life. Discussions with community people help students see how metrics will affect their daily lives.

Discussion of the metric units, prefixes, and the use of the decimal system is included. However, the actual learning of the metric units takes place in a series of eight learning stations in a "hands-on" approach. Using the metric system is the most efficient and most fun way to learn to live metrically.

PERFORMANCE OBJECTIVES

1. By following the history of the metric system in the world and sharing in the world map provided, the student will conclude that the U. S. is the major country which does not use the metric system.
2. After exploring the environment and bringing to class items which have metric labeling and sizes, the student will recognize that the metric system is already a part of our everyday life.
3. Following a teacher-led discussion on why we should use the metric system, the student will be able to list at least five reasons why metrics will be an advantage to the consumer.
4. Given a discussion, the student will understand why there has been some consumer resistance to the change to metrics.
5. After talking with people in the community, students will gain an insight into how metrics will affect their lives and will recognize the need for a well planned transition fromthe customary to the metric system of measurement.
6. Given a list of objects, pictures of objects, and common sayings using measurements, the student will identify the metric unit which will replace the customary unit.
7. When writing metric units, the student will be expected to write the symbols correctly with 75% accuracy.
8. Given references, the student will learn the meanings of the prefixes used in the metric system by relating them to our money system and to other words with similar prefixes.
9. Given an exercise, the student will demonstrate his/her ability to work with metric units of the metric system.
10. Given a cubic decimeter, the student will observe the physical relationship among the metric units.

LEARN THE METRIC SYSTEM BY DOING

(PERFORMANCE OBJECTIVES)

A. Mass (red station)

1. Given a set of common objects, the student will estimate the objects weight correct to the nearest gram or kilogram.

2. Given an equal-arm balance, the student will weigh and record the weights of the common objects correct to the nearest centigram.

3. Given an object's estimated and observed weight, correct to the nearest centigram, the student will compute the amount over or under the estimate.

B. Volume (purple station)

1. Given a set of common objects, the student will estimate the volume of water the container holds to the nearest milliliter.

2. Given a milliliter measure, the student will measure the volume and record the volume to the nearest milliliter.

3. Given the container's estimated and observed volume, correct to the nearest milliliter, the student will compute the amount over or under the estimate.

C. Temperature (blue station)

1. The student will discover the range of a Celsius thermometer, how it is calibrated, and determine common temperatures by developing a thermometer.

2. Given pictures of different weather conditions, the student will determine the approximate Celsius temperature.

D. Personal Measurements (green station)

1. The student will develop useful gauges for estimating the size of objects by taking personal measurements in metric.

2. Given common objects to measure, the student will estimate the length of the object to the nearest centimeter.

3. Given a centimeter measure, the student will measure the common objects and record the length to the nearest centimeter.

4. Given the object's estimated and observed length, correct to the nearest centimeter, the student will compute the amount over or under the estimate.

E. Length (turquoise station)

1. The student will develop his own measuring tools based on the English system and determine how scientific this system is.

2. Given common objects to measure, the student will estimate the length of the object to the nearest centimeter.

3. The student will demonstrate his ability to measure in meters and centimeters by actually measuring the same items.

4. Given the objects estimated and observed length, correct to the nearest centimeter, the student will compute the amount over or under the estimate.

F. Map Making (pink station)

1. After constructing a kilometer scale for distances on a map to other towns in our state, the student will develop a kilometer chart.

2. Using the kilometer chart, the student will determine the time needed to travel to these towns using various speed limits.

G. "Rule of Thumb" Conversions (yellow station)

1. Given a table of "rule of thumb" conversions, the student will answer questions which relate the two systems of measurement.

H. Tic Tac Toe (orange station)

1. Using the game of Tic Tac Toe, the student will review questions on all aspects of metrics important to the consumer.

PRE-TEST
METRIC SYSTEM

Name:_____

I. True or False: Decide if each of the following statements is true or false. If it is true place a T in the blank to the left of the number. If it is false, place an F in that blank.

_____1. Everyone in the world, except the U. S. and France, is using the metric system of weights and measures.

_____2. Metrics has been debated in the United States Congress for over 150 years.

_____3. The pharmaceutical companies switched to metrics in 1976.

_____4. In the metric system, we will use a kg to measure what we used to measure in pounds.

_____5. In the metric system, we will use the meter to measure what we formerly measured in feet and yards.

_____6. In the metric system, we will use a liter to measure what we used to measure in pints and quarts.

_____7. A temperature of 40°C will be cool.

_____8. Our money has always been metric.

_____9. There are 700 grams in 7 kg.

____10. A milligram is larger than a centigram.

II. Multiple Choice: Select the best answer for each of the questions below. Put the letter designating your answer in the blank to the left of the number.

____11. Which is more? A. meter B. yard

____12. Which is more? A. kilometer B. mile

____13. Which would be more filling? A. a liter of pop B. a quart of pop

____14. The metric system is based on the number
A. 1 B. 5 C. 10

____15. A gram weighs about as much as
A. a paper clip B. coffee cup C. ½ pint of whipping cream

____16. In the language of metric, instead of counting calories, we will count
A. lentils B. Joules C. nutons

____17. If you take your temperature in the morning, and it is 37°C, you should
A. go to the doctor B. get dressed and go to school

III. Arrange the following prefixes in the correct order beginning with the smallest. kilo, milli, centi, deci

_____ _____ _____ _____
smallest largest

HISTORY OF THE ACCEPTANCE OF THE METRIC SYSTEM THROUGHOUT THE WORLD

OBJECTIVE 1.

By following the history of the metric system in the world and shading in the world map provided, the student will conclude that the U. S. is the only major country which does not use the metric system.

CONTENT	ACTIVITY
circa 1790 -- Beginning of the metric system in France. circa 1840 -- France made the metric system compulsory. circa 1855 -- Columbia goes metric: first South American country. 1866 -- U. S. makes it legal to employ the weights and measures of the metric system. 1877 -- International "Treaty of the Meter" is signed by 17 countries including the U. S. circa 1880 -- Norway goes metric: first Scandinavian country. 1893 -- U. S. sets standards for the yard and pound in terms of the meter and kilogram. 1900 -- Mexico goes metric: first North American country.	Use the materials for transparencies and overlays on pages 66-69 to present this material. Provide each student with a copy of the world map, page 69. Have the students shade in the parts of the world using metric as you proceed. Suggest that students take the map home and share it with their families.

CONTENT	ACTIVITY
circa 1900 -- At least 34 countries have adopted the metric system, including most of Europe, Scandinavia, and most of South America.	
circa 1917 -- Cambodia goes metric: first Asian country.	
circa 1930 -- Russia goes metric.	
circa 1940 -- at least 65 countries have adopted the metric system.	
1965 -- Great Britian goes metric.	
1968 -- U. S. Congress passes the Metric Study Act.	
1970 -- At least 82 countries have adopted the metric system.	
1971 -- The report on the Metric Study is undertaken by the National Bureau of Standards. Report concludes that U. S. will go metric.	
1975 -- In the past ten years 25 countries have gone metric, includes Japan, Australia, and Africa.	
1975 -- President Ford signs Metric Conversion Act committing our nation to metrics. This act established a national metric board	

CONTENT		ACTIVITY
	whose function it is to coordinate the increasing use of metrics in the United States and to provide an organized plan for adopting its use.	
1976	-- Canada goes metric.	
1977	-- U. S. only major uncommitted nation to metric system. Keeps company with Brunei, Burma, Liberia and Yemens.	
Conclusion:	The United States is an island in a metric world. Over 90% of the world is metric.	Discuss: Why has the metric system been so widely accepted?

Source: Ryan, William T. and Vest, Paul Joe. Modern Metrics Made Easy, (Clearvue, Inc.), "Important Dates in the Development of a Metric World."

THE METRIC SYSTEM IS ALREADY A PART OF OUR EVERYDAY LIFE.

OBJECTIVE 2.

After exploring the environment and bringing to class items which have metric labeling and sizes, the student will recognize that the metric system is already a part of our everyday life.

CONTENT	ACTIVITY
1. Pharmaceutical companies went metric over 15 years ago -- prescriptions. 2. Money is metric. 3. One-fourth of all cars on the highway are foreign made and require metric tools and mechanics who know the language. 4. 1974 -- Pinto and Mustang engines were built to metric measurements. 5. All nutrition information for food products is given in metric units. 6. Dress patterns are given with dual measurements. 7. The first men on the moon (Armstrong and Aldrin) recorded their walk in meters. 8. Road signs in many states mark distances in kilometers. 9. Skiis and ski boots are measured in centimeters.	Household Caper: Explore your environment for items which already contain metric labeling. See page 53 for form. This may be done as a team activity developing posters or bulletin boards with the information and giving a prize to the team with the most items. If students do not bring items to class, be prepared to show examples of labels, advertisements, prescriptions, etc. Or use the transparency suggestions on pages 70-72.

CONTENT	ACTIVITY
10. Camera bugs click 8-16-33 mm cameras. 11. Food labels on over 50% of our processed foods state weights in both customary and metric units. 12. Everytime we buy a light bulb or pay the electric bill we use the metric system: watt, volt, ampere, kilowatt. 13. Eyeglasses are measured in millimeters -- size 50 is 50 millimeters. 14. Hunters use 7 mm and 8 mm rifles. 15. Luggage limit on overseas flights is 44 pounds. Why not 40 or 45? 44 pounds converts easily to the metric unit of 20 kg. 16. Events in Olympic games are measured in meters. 17. Olympic size pools -- 50 m x 25 m. 18. In 1974, Riverfront Stadium in Cincinnati began measuring home runs in meters -- 130 meters (425 feet) 19. Some of the Army maps are metric. 20. Scientific industries have used metrics for years.	As you proceed with the discussion make a list of all metric terms encountered: gram cubic centimeter milliliter meter watt volt ampere kilowatt kilometer millimeter liter milligram Divide your class into groups and prepare a series of articles for your school or city paper. Begin by writing one on how we are already "Living Metrically."

WHY SHOULD WE USE THE METRIC SYSTEM?

OBJECTIVE 3.

Following a teacher-led discussion on why we should use the metric system, the student will be able to list at least five reasons why metrics will be an advantage to the consumer.

CONTENT	ACTIVITY
1. 90% of the world is already metric. Do we have the right to remain separate or to expect them to switch to our system?	
2. Improve international communication.	
a. The metric system is the only kind of language in which our exporters may sell and trade their goods to the rest of the world so that there is no misunderstanding at either end.	On the outline of the world map, draw arrows from the U. S. to its major world partners. They are all countries in which metrics are used for measurement.
b. A common language would be an advantage in setting standards with the rest of the world.	
c. U. S. military allies use the metric system; military coordination and logisitics would be simplified.	

CONTENT	ACTIVITY
3. Our economy depends on trading materials, products, and technological ideas abroad.	
a. Manufacturers could produce one line of products equally acceptable for both internal and external markets.	
b. Many companies who trade abroad have found it advantageous to build where they can employ workers who know the metric system.	
4. The metric system is simpler than English.	Give the paper-and-pencil test "Are You Ready for Metrics?" on page 54 orally. Have students mark down answers on a sheet of paper and let students grade their own papers.
a. In the English system the relationship of units is not consistent.	
(1) an ounce can mean either volume or weight.	
(2) a dry quart is about 16% larger by volume than a liquid quart.	
b. In the English system there are many more units of measurement to remember than in the metric system.	Name the English units of measurement and list on board: ounce, yard cup, mile pint, rod quart, fathom gallon, acre bushel, fahrenheit peck, pound inch, ton foot, grain barrel
c. In the metric system there is one series of units for:	Make a poster or transparency for each of these metric units using the ideas on pages 73-74.
(1) Length -- think meter (2) Volume -- think liter (3) Mass -- think kilogram (or gram)	Ask the class what English units these metric units replace. Cross out the term on the board as it is replaced.
There is no longer a need to remember the many factors to relate inches, feet, yards, pints, quarts, gallons.	

CONTENT	ACTIVITY
5. The metric system is more precise. a. Metric scales are more precise when measuring by gram than by fractions of an ounce. (1) one ounce is equal to a little less than 30 g. (2) inconvenient to break ounce into that many fractional parts. b. Many of the commodities we now use were standardized in metrics and then converted to English units which are less precise.	
6. Comparison shopping with metrics should be easier. a. In most countries, the consumer can compare food costs without a calculator.	Use "Comparison Shopping" example on page 75. May be put on transparency or used on chalk board.
7. Eliminates necessity for individuals to learn two measurement languages -- one for job, one for daily life.	
8. May eliminate some of the confusion in purchasing which now exists. Examples: a. Shoe and stocking size bear no relationship -- same person may wear a size 4 shoe and an 8½ sock. b. Some woman might wear a 10 dress, 34 blouse, 38 sweater, 36 slip, 6 3/4 glove, size 8 shoe, and size 10 stocking. c. Screws - the larger the number, the larger the diameter of the screw; wire sizing is just the opposite. d. Most of our units for purchasing are unrelated.	

WHY HAVE WE NOT SWITCHED TO METRICS?

OBJECTIVE 4.

Given a discussion, the student will understand why there has been some consumer resistance to the change to metrics.

CONTENT	ACTIVITY
People in the United States have been arguing about the metric system for over 200 years. So, why haven't we already changed?	Do you think it would be advantageous or disadvantageous to switch to metrics? Let students use one of the following activities to express both points of view.
1. The greatest obstacle is human resistance to change -- probably greater among the older generation than the younger generation.	Write a brief paper.
	or
2. Fear of the cost of change -- cost depends upon the way the change is made and if the items to be replaced can be removed when they are worn or outdated.	Tape record a conversation with a friend or family member.
	or
3. Fear of how it will affect our lives.	Prepare a short skit.
	or
4. Customary units are closely related to our human anatomy and are convenient for estimation purposes.	Draw a series of cartoons.
	or
5. The metric units are too large or too small for young children to handle easily.	Write a poem.
a. A meter is longer than a yard. b. A centimeter is shorter than an inch. c. The metric system has no unit comparable to the foot.	

HOW WILL METRICS AFFECT OUR DAILY LIVES?

OBJECTIVE 5.

After talking with people in the community, students will gain an insight into how metrics will affect their lives and will recognize the need for a well planned transition from the customary to the metric system of measurement.

CONTENT	ACTIVITY
1. Should we throw out all of our tools and equipment? a. No, for a long time we will be living with both systems. As long as favorite family cookbooks and recipes are passed down from generation to generation, we may want our present measuring devices. b. As our tools and equipment wear out, they can be replaced with metric ones.	Invite a guest who has lived in a country that uses the metric system to speak in class. or Invite a panel of community people--service station attendant, store manager (lumber, hardware, clothing), a surveyor, etc.--to discuss what is happening and will happen in their businesses during the switch to metrics.
2. What short and long terms effects will metric conversion have on prices, job opportunities, inflation, labor and consumers? a. In the 1960's it was estimated that it would cost eleven billion dollars to convert to the metric system. b. But, we are losing millions of dollars in trade each year because we do not produce in metric units. c. Some companies are losing substantial dollar amounts because they have to produce commodities in both metric and English units. d. It's been calculated that from 6 months to 2 years of elementary school arithmetic could be eliminated with the switch to metrics.	or Take a field trip and visit two or three business places and interview the managers. or Divide the class into groups to identify how metric measuring will affect our daily lives. Example topics for discussion: Buying food, Buying clothing, Buying shoes, Cooking, Building a House, Buying land, Temperature, Transportation, Comparing Prices, Decorating a Home See additional examples of how metrics will affect consumers in appendix, page 55.

CONTENT	ACTIVITY
(1) In the 1960's the president of the metric association calculated that 705 million dollars a year could be saved by eliminating the teaching of the English units and the extensive drill on fractions.	
5. Retraining of employees by their companies will be necessary.	Prepare two newspapers articles. 1. How will metrics affect our daily life? 2. Long and short term effects of metric conversion.

USING THE METRIC SYSTEM

OBJECTIVE 6.

Given a list of objects, pictures of objects, and common sayings using measurements, the student will identify the metric unit which will replace the customary unit.

CONTENT	ACTIVITY
1. We are changing to a system known as System International. Everyday usage of this language will include the following units which are either part of the basic units or derived from them. a. Meter (m) -- unit of length b. Kilogram (kg) -- unit of mass c. Liter -- (L) unit of liquid capacity d. Celsius (^{o}C) -- a unit of temperature e. Joules (J) -- replaces calories as a unit of energy f. Second (s) -- a unit of time g. Ampere (A) -- a unit of electric current h. Watt (W) -- measures power	Present each unit with a transparency. (See pages 79-87.) Show pictures of various objects and have the class determine which unit would be used to measure each. Examples: weather pictures car (speed) gas tank shoes oranges paneling pop bottle Have students replace the English measurement unit in the "Common Sayings" on page 56 with the metric unit. Use "Handyman Hank" #1 on page 57.

USING THE METRIC SYSTEM (CONTINUED)

OBJECTIVE 7.

When writing metric units, the student will be expected to write the symbols correctly with 75% accuracy.

CONTENT	ACTIVITY
1. One of the main advantages of SI is that there is a unique symbol for each unit. These remain the same in all languages. There are basic rules for the use of these symbols. a. The symbols are always printed in Roman upright type except liter where a capital L should be used. b. The symbols do not change in the plural. (10 kilometers is 10 km) c. Symbols are never written with a period at the end unless they come at the end of a sentence. (110 km not 110 km.) d. There is a space between the number and the symbol (90 g), but when the first character of a symbol is not a letter, no space is left. (45°C) e. Temperatures are either written as degrees Celsius or as °C, not degrees C. f. When using a decimal fraction less than one, always place a zero before the decimal point. (0.45 kg) g. Spaces are used instead of commas to divide a long row of numbers into three (21 000).	Use tranparencies on pages 85-88 to present these rules.

CONTENT	ACTIVITY
h. Avoid mixing units. (1.34 m not 1 m 34 cm)	
i. All symbols are written in lower case except where the unit is derived from a proper name. (kg but J [Joule], C [Celsius], W [Watt], -- Liter [L] is now an exception to this rule also.)	Have students practice writing symbols on the chalkboard. Place as many students at the board as possible. Show them a picture of an object. Identify the metric unit used to measure it by writing its symbol on the board. When a mistake is made let the student who catches the error replace that student.
j. Liter and meter may be written "er" or "re." Technical publications tend to favor the latter spelling.	
k. Do not use a prefix as a word. (a kilogram of flour not a kilo of flour)	

USING THE METRIC SYSTEM (CONTINUED)

OBJECTIVES 8 and 9.

The student will learn the meanings of the prefixes used in the metric system by relating them to our money system and to other words with similar prefixes.

Given references, the student will learn the meanings of the prefixes used in the metric system by relating them to our money system and to other words with similar prefixes.

CONTENT	ACTIVITY
1. The metric system is based on a unit of 10 just like our monetary system.	Use form on page 89 to make a transparency. Duplicate copies for students.
a. One of the advantages of the metric system is the efficiency with which words are used.	
(1) Associated with each basic unit is a series of prefixes. milli deci centi kilo You may wish to also point out the use of the prefixes deka 10 x hecto 100 x mega 1 000 000 x	Refer to column 4.
(2) These prefixes have the same meaning whether they are modifying a basic unit of length, volume, or weight.	Refer to columns 5-7.
(3) To make it easier to remember these prefixes, relate them to our monetary system.	Refer to columns 1-4.
b. Many of the words in our English language use these same prefixes. centennial millipede decade centipede	Have a dictionary available for the enthusiastic student.

USING THE METRIC SYSTEM (CONTINUED)

OBJECTIVE 10.

Given a cubic decimeter, the student will observe the physical relationship among the metric units.

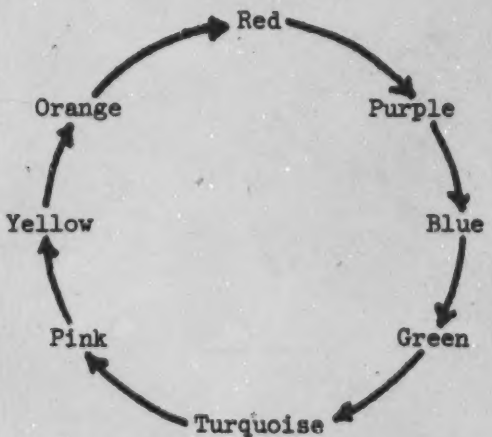
CONTENT	ACTIVITY
1. All of the metric units are interrelated.	See page 52 to order a cubic decimeter or to obtain a pattern for a cubic decimeter.
a. I am a cubic decimeter (dm^3). I have 3 dimensions -- length, width, and height (depth) so I am a cube.	
b. My <u>length</u> measurements are 1 dm x 1 dm x 1 dm = 1 dm^3 or 10 cm x 10 cm x 10 cm = 1 000 cm^3	You may wish to have templates and scissors available so that each student can make their own. or Use transparencies on pages 90-91.
c. If you filled me with water, I would contain a liquid volume of 1 L.	
d. If you filled me with water and weighed me I would have a mass of 1 000 g or 1 kg.	
e. Now check yourself.	
(1) How many liters of water does the box contain? (1 L)	
(2) What is the length of one edge? (100 mm, 10 cm, 1 dm)	
(3) What is the mass of a liter of water? (1 kg)	Use the box to estimate the length of a pencil, how many boxes of water it would take to fill an aquarium or any available container, and how heavy the container would be when filled with water.
(4) What is the mass of 1 mL of water? (1 g)	
(5) How many cubic centimeters does the box contain? (1 000 cm^3)	

LEARNING METRICS BY DOING

As the class begins, give each student a color coded tag. The color received will indicate the station at which each student is to begin his/her participation in the "round robin" presentation. A paper placement of colors can identify the learning stations. Prior to class the teacher will have prepared each station and placed arrows indicating which direction the students are to go as they complete each station.

This project will take considerable time to set up, but once set up, it will be an ongoing experience for 2 to 3 days. A supply list is provided on pages 25-26. You may wish to invite patents into the class to help. If parents are involved, make sure they understand what is expected of them at the stations they supervise.

There are eight stations planned. Each station requires active participation by all students. They were planned for three to four students to occupy one station at a time. The number could easily be increased or decreased. You may find it helpful to divide into only seven groups and leave one station open at all times. Provide enough room at each station so that it would be possible for two groups to work at the same time. An alternative plan would be to set up only 3 to 4 stations each day. The session may be preceded with some examples of the various experiments, for example: how to weigh on the gram scale.



Stations:

Red: Mass	Purple: Volume	Blue: Temperature
Green: Personal Measurements	Turquoise: Length	Pink: Map Making
Yellow: "Rule of Thumb" Conversions	Orange: Metric Tic Tac Toe	

Competition has been built into the learning activities. The learning stations involving mass, volume, length, and metric tic tac toe state that an award will be given at the end of the unit. A copy of a certificate you may use is included on page 92. A lollipop, chocolate mint, etc. may be attached in the large circle. The following titles may be used for the awards:

Grammy Award (closest guess on mass) Liter of the Pack (closest guess on volume)
Neater Meter (closest guess on length) Metric Quiz Whiz (Tic Tac Toe winners)

SUPPLY LIST FOR LEARNING STATIONS

(BASED ON GROUPS OF 4)

MASS (RED STATION)

1 Report sheet per student
5 straight, pointed pins
1 paper clip
5 nickels
1 flashlight battery (size D)
2 7-oz. cans of tuna
9 sticks margarine
1 eraser
1 piece of bubble gum
1 banana
1 16-oz. bottle of pop
1 1-lb. box of crackers
2 scales -- one for body weight*
one which will measure grams*

VOLUME (PURPLE STATION)

1 Report sheet per student
1 metric measuring utensil *
1 full 16 oz. Coke bottle
1 empty 16 oz. Coke bottles
1 liter flask
1 tea cup
1 drinking glass
1 large container for water (or sink)
1 large container marked "V"
1 measuring cup

TEMPERATURE (BLUE STATION)

1 Report sheet per student
1 1# box of rock salt
1 hot plate or electric fry pan to heat water
1 pan of water
1 glass jar or flask
1 bag crushed ice or snow
2 Celsius thermometers (1 oral thermometer, 1 indoor-outdoor thermometer*)

PERSONAL MEASUREMENTS (GREEN STATION)

1 Report sheet per student
1 metric tape measure*
1 meter stick*
1 height chart on wall in centimeters (may use horizontal strips of tape at 10-cm intervals)

*Your Regional Educational Media Center has one of these in the "Metric Trunk" of teaching supplies.

SUPPLY LIST (continued)

LENGTH (TURQUOISE STATION)

1 Report sheet per student
1 ball of string
1 pair of scissors
1 meter stick*
1 yardstick
1 length of tape of wall marked "X" cm

MAP MAKING (PINK STATION)

1 Report sheet per student
8 state maps/1 per group
(need not be the same)
8 strips cardboard (2 cm x 45 cm)
1 metric ruler*
1 ice pick or pointed instrument for punching holes in cardboard

"RULE OF THUMB" CONVERSIONS (YELLOW STATION)

1 Report sheet per student

METRIC TIC TAC TOE (ORANGE SECTION)

This activity is planned for 4 people per group. If your groups exceed this number, you may want more equipment and you will need to revise the play-off chart (page 44).

2 sets of questions mounted on heavy paper
2 pieces of cardboard divided with lines as a tic-tac-toe card
2 sets of checkers or squares of colored paper in 2 different colors
1 set of directions taped to the table

*Your Regional Educational Media Center has one of these in the "Metric Trunk" of teaching supplies.

MASS (RED STATION)

Name: _____

A. The metric unit used to measure mass is the

_____.

1. A kilogram = _____ grams.
2. A centigram = _____ grams.
3. A milligram = _____ grams.

B. At the table are several items which are labeled with their approximate weights. As you lift each item, study the chart below and try to compare its standard "feel" so that you can begin to "Think Metric."

Remember: 1 oz. = approximately 30 g
1 lb. = 0.45 kg
2.2 lbs.= 1 kg

Item[1]	Weight	Memory Aid
5 straight, pointed pins	0.5 g	pointed
1 paper clip	1 g	single
5 nickels	25 g	25¢
1 flashlight battery (size D)	100 g	
7 oz. can tuna	200 g	tuna
2 - 7 oz. cans tuna	400 g	2 tuna
4 sticks margarine	500 g	1 lb.
9 sticks margarine	1 kg	better than 2 lbs.

[1]Adapted from Thinking Metric by Thomas F. Gilbert and Marilyn B. Gilbert, John Wiley and Sons (1973).

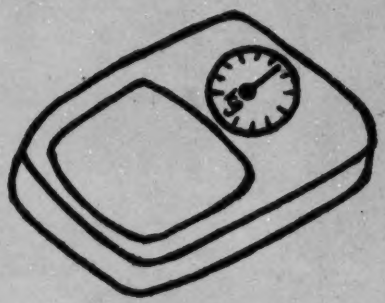
C. After studying the items in the chart on the preceding page, estimate the weight of the following items:

Item	A Estimated Weight	B Actual Weight	C Difference Between A & B
1. Piece of bubble gum			
2. Bottle of pop			
3. Ball			
4. Banana			
5. Eraser			
6. Box of crackers			

D. Weigh each of the items above and record the actual weight in column B. Determine the difference between the estimated weight and the actual weight of the object and record in column C.

E. Estimate your own body weight in kilograms.

1. _____ kg



Weigh yourself on the scale and determine your actual weight in kilograms.

2. _____ kg

Note: If you're using a scale calibrated in pounds/ounces, divide the number of pounds by 2.2 to calculate the kilograms. (2.2 pounds equal 1 kilogram)

3. Which weighs more, a $20.00 stack of nickels or a stack of nickels equal to my weight? (See table on previous page.)

Answer: _____

F. Estimate the mass of the item marked M. An award will be given to the student with the estimate closest to the actual mass at the end of the module.

Estimate: _____

Is your name on this paper?

Turn in your paper and proceed to the purple station.

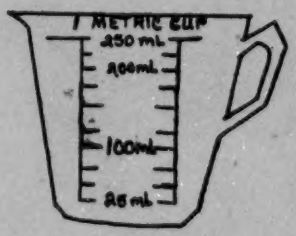
VOLUME (PURPLE STATION)

Name:_____

Volume in the metric system is measured most often by the liter. It is slightly larger than a quart. Look at the quart milk carton. If that carton were 5% larger it would equal approximately 1 liter.

For smaller volume amounts, the milli-liter will be used. A milliliter is equal to .001 liters.

1. Fill the customary measuring cup with water and pour it into the metric measuring cup. How many milliliters does 1 cup hold?



_____ mL

A standard metric measure will hold 250 mL. Is this slightly larger or smaller than our customary measuring cup?

_____

2. Fill the metric measuring cup with 100 mL. Pour this into the empty Coke bottle.

Now estimate with your eye how many mL the full Coke bottle contains.

_____ mL

Check your estimate by filling the empty Coke bottle until the water is the same height as the Coke in the capped bottle. Pour the water into the metric measuring cup and measure the contents of the bottle.

What is the actual measurement of the Coke bottle? _____ mL

How far off was your estimate? _____ mL

3. Fill the tea cup with water. Pour the water into the metric measuring cup. How many mL servings did the tea cup hold?

_____ mL

Estimate the number of mL of water the glass will hold. _____ mL
Fill the glass with a typical serving of drinking water. Pour the water into the metric measuring cup. How many mL of water did it contain?

_____ mL

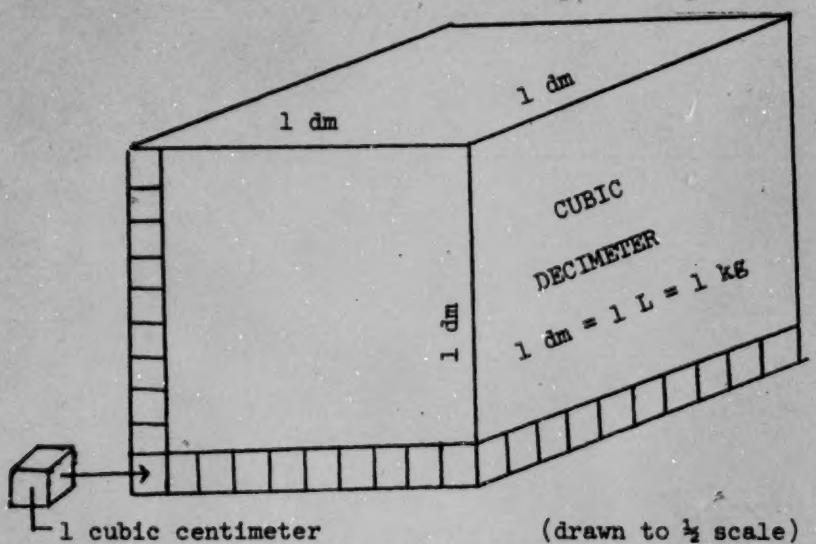
How far off was your estimate? _____ mL

4. Fill the empty flask with exactly one liter of water. By visualizing what one liter "looks like," estimate the amount of the contents in the container marked "V."

_____ mL

A prize will be given to the student who most accurately estimates the volume at the end of this module.

5. Volume may also be visualized as a cubic decimeter. One cubic decimeter is equal to one liter. (1 dm^3 = 1 L) From class discussion, you will recall that the mass of 1 L or 1 dm^3 equals 1 kg.



(drawn to ½ scale)

Another way to calculate the volume of a liter is 10 cm x 10 cm x 10 cm = 1 000 cm^3.

Since a mL is 1/1000 of a liter, it is also equal to 1 cm^3. Drugs, especially liquid medicines, are often dispensed in this unit. (Note: In medicine cubic centimeter is often abreviated cc.) From class discussion, you will recall that 1 mL or 1 cm^3 equals 1 gram.

Answer the following:

a. 10 cm^3 = _____ mL = _____ g

b. 1 dm^3 = _____ L = _____ kg

c. A teaspoon holds approximately 5 mL. How many cubic centimeters does it contain?

_____ cm^3

d. Your druggist has indicated on the label of your prescription that you should take 5 cc. How many teaspoons is that?

_____ teaspoons

How many mL is that? _____ mL

Is your name on this paper?

Turn your paper in and proceed to the blue station.

TEMPERATURE (BLUE STATION)

Name:_____

A. Identifying Convenient Points on the Celsius Temperature Scale

1. Determining the boiling point of water. Pour water into the pan until it is half full. Heat the water until it begins to boil. (Bubbles rise to the top and break the surface.) Gradually insert the thermometer into the water. (Note: If you insert the thermometer too quickly, it may break.) Record in pencil the temperature of the boiling water on your thermometer and label it "Boiling Point of Water."

2. Determining the freezing point of water. Fill the glass container with crushed ice (or snow). Add just a small amount of water. See how cold you can get the temperature. Mark the lowest temperature you obtain on your thermometer in pencil and label it "Freezing Point of Water." What kind of day would this be like outdoors?

   _____

3. Gradually add rock salt to the water-ice solution until the temperature will not go any lower. Record this temperature on your thermometer in pencil.

   This temperature is loved by skiiers and ice skaters. The snow will stay on the ground and the ice will not melt. Label the temperature "Skiing Weather."

   What affect did the rock salt have on the ice? _____

   Why do we salt the roads and highways after a snowfall in 0°C to -10°C weather? _____

4. Determining room temperature. What is the room temperature in degrees Celsius? _____ Mark this temperature on your thermometer in pencil and label it room temperature.

   What kind of day would this be like outdoors? _____

5. Determining body temperature. Using the oral thermometer, take the temperature of one of the members of your group. Record that temperature on your thermometer in pencil and label it body temperature. (If an oral thermometer is not available, your teacher will supply you with this information.) Gently "shake-down" the thermometer and clean it.

   Since the difference between the boiling and freezing points of water is only 100 degrees on the Celsius thermometer (as compared to 190° on the Fahrenheit thermometer), the consumer should be aware that a change in body temperature of one to two degrees is a greater concern.

   What kind of day would this be like outside? _____

6. Determining the outdoor temperature. Estimate today's temperature.

   _____°C Record the actual temperature on your thermometer in pencil and label it with a word or picture indicating how that temperature feels. (examples: mittens, sun, beach ball, ice skates)

B. Optional Activity

   Cut out the small half circles on your thermometer. Staple together one end of a red ribbon and a white one. Thread the ribbon through the holes you just cut out so that the ribbon runs up the face of the thermometer.

   You can now use the red part of the ribbon to show various temperatures. Use this to help your families learn to "Think Metric."

C. Without using your thermometer, write the Celsius temperature of each condition on the line below the picture.

Normal body Temperature

1._____

Temperature of ice cubes

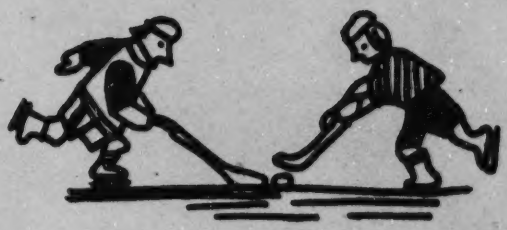
2._____

Temperature of boiling water

3._____

Approximate room temperature

4._____



Approximate outdoor temperature

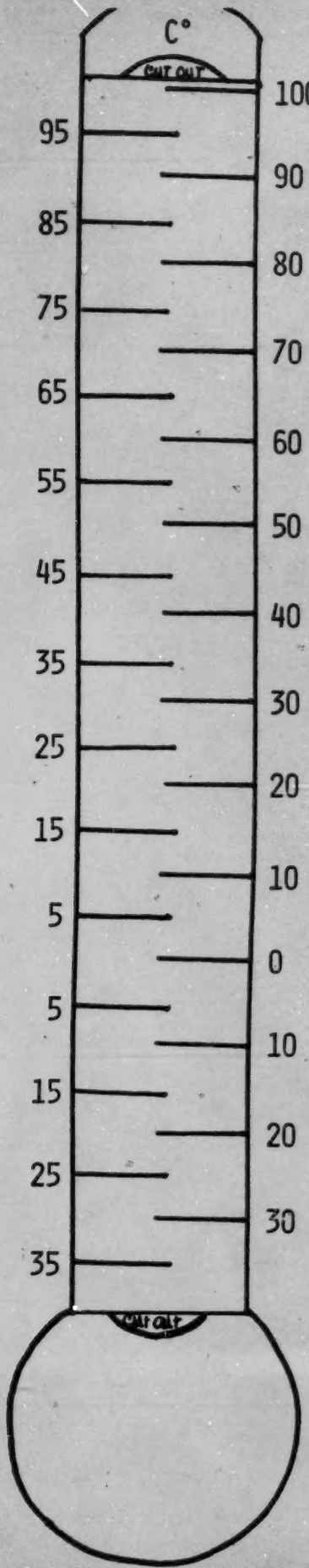
5._____

Check your answers using your thermometer. Did you get all of them correct?

_____

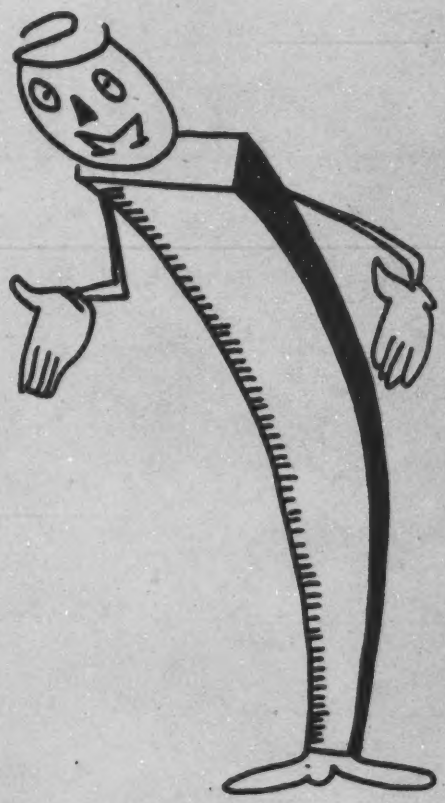
Is your name on this paper and on the back of your thermometer?

Turn in your paper and thermometer and proceed to the GREEN STATION.


C°
CUT OUT
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
5
10
15
20
25
30
35
CUT OUT

PERSONAL MEASUREMENTS (GREEN STATION)

Name:_____



1. Height: I am _____ cm tall.

   I am _____ m tall.

   Which of the above measurements will become the most commonly used? _____

2. Which amount is greater: a stack of pennies as tall as I am or a stack of pennies worth $10.00? (Note: a stack of six pennies is about 1 cm tall.)

   _____

3. Measure your waist. _____ cm What is your belt size? _____ cm

4. Measuring from heel to heel, what is the length of your average step? _____ cm

   Using the length of your step, estimate the width and length of this room.

   _____ m (width) x _____ m (length)

5. Draw an outline of your foot on a piece of paper. The metric system of shoe sizing calls for two numbers. The first is the length of your foot in centimeters and the second is the width of your foot in centimeters. What is your shoe size?

   _____ cm (length) _____ cm (width)

   Using the length of your foot, estimate the width of this room.

   _____ m

   Is this measurement the same as the width measurement in #4? _____

   If not, what is the difference? _____

   What are the exact dimensions of this room? _____ m x _____ m

6. Measure the distance between your little finger and your thumb with your hand spread. _____ cm

   Using your handspread, measure the width of table/desk you are working at.

   _____ cm What is its actual measurement? _____ cm

7. Measure the width of your index finger. _____ cm or _____ mm

   Using your index finger, estimate the width of this paper. _____ cm

   What is its actual measurement? _____ cm

8. Where on you is something one meter long? _____

   Where on you is something one centimeter long? _____

   Where in this room is something measuring approximately one meter long?

   _____

   Where in this room is something measuring approximately one centimeter long?

   _____

OPTIONAL ACTIVITIES

9. What is your ring size? _____ mm

   Find an object in the room that has a circumference approximately the same size. _____ mm Measure the circumference. _____ mm

10. Measure the circumference of your head? _____ cm

    Find an object in the room that has a circumference approximately the same size. _____ cm Measure the circumference. _____ cm

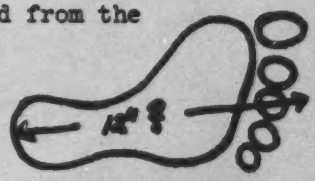
Is your name on this paper?

Turn in your paper and proceed to the turquoise station.

LENGTH (TURQUOISE STATION)

Name: _____

A. The English system of the yard, foot, and inch were developed from the following:



yard -- distance from thumb to nose
foot -- length of foot
inch -- width of thumb

1. Cut a length of string equal to your body measurements for the yard, foot, and inch.

2. Compare the strings to those of the other members of your group.

   Are they the same length? _____

   If so, which ones are? yard foot inch

3. Measure the length and width of the table with your string.

   Length _____ Width _____

4. Compare your measuring devices with the yardstick.

   Are your yard, foot, and inch string pieces the correct length?

   If so, which ones? yard foot inch

5. How scientific was the development of our English system?

B. The meter was derived from the distance from the North Pole to the equator divided into 10 million parts, each of which was a meter.

1. Compare the length of the meter stick with a yardstick.

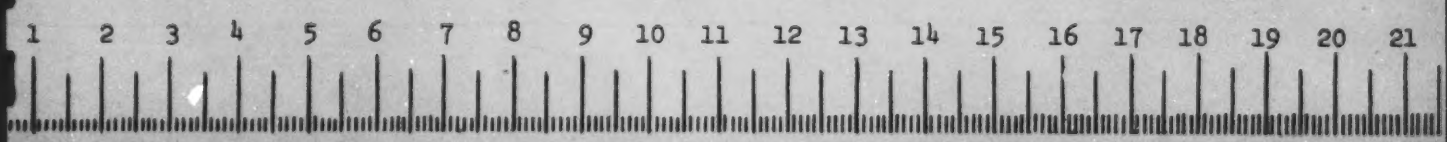
2. Which is longer? _____

3. By approximately how much? _____

4. How many cm are there in the meter? _____ cm

C. 1. Measure the height of an average doorway in meters. _____ m

2. A single meter is approximately _____ the height of an average doorway or _____ cm.



D. Knowing that a meter is approximately one-half the height of an average doorway, estimate the length of the following.

Item	Estimate	Actual	Difference
1. Distance from floor to ceiling	_____	_____	_____
2. Height of windows	_____	_____	_____
3. Width of windows	_____	_____	_____
4. Width of teacher's desk	_____	_____	_____
5. Height of chalkboard	_____	_____	_____
6. Length of this piece of paper	_____	_____	_____

Check your measurements with the meter stick and fill in the actual measurement. Determine the difference between your estimated length and the actual measurement.

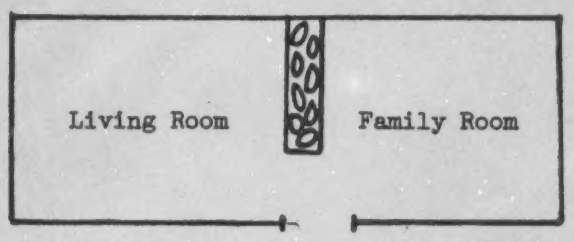
E. On the wall is a length of tape marked X cm. Estimate its length as nearly as you can.

_____ cm

An award will be given to the person with the best estimate when we have completed this module on metrics.

F. In the metric system area is measured by square meters (m^2). Land area is measured in hectares. 1 ha (hectare) is a little smaller than 2 football fields.

The following floor plan has a scale of 1 cm = 1 m.



1. Using the centimeter scale along the bottom of the preceding page, determine the measurements of the living room. _____ m x _____ m
2. How many square meters of carpet would you order for the living room?

_____ m^2

3. If you decided to tile the family room with tiles 100 cm^2, how many tiles would you need? _____ tiles

Is your name on this paper?

Turn in your papers and proceed to the pink station.

MAP MAKING (PINK STATION)

Name:_____

A. Map Making[1]

1. Select one map for your entire group. Locate the scale on the map.

2. Using the following conversion table, convert the mileage scale to kilometers:

   10 miles = 16 km
   15 miles = 25 km (actual measurement is 24 km)
   20 miles = 32 km
   30 miles = 50 km (actual measurement is 48 km)
   50 miles = 80 km

   Note: If your map uses another scale, please include it in the table shown above.

3. Determine what the scale on your map would be in inches to equal 15 miles or 25 km.

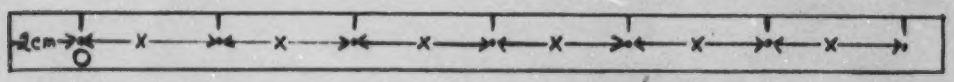
   Example: If 1 inch = 10 miles = 16 km then
   1½ inches = 15 miles = 25 km

4. Draw a line on a piece of paper equal to the scale needed for 25 km on your map.

5. On one of the cardboard strips provided, mark point zero 2 cm in from one end.

6. Using your scale and starting at point zero on the cardboard strip, measure off and mark in pencil as many scale lengths as possible.

   Scale ⟵ x in. ⟶ = 25 km



Cardboard strip marked in scale of x in. = 25 km

7. With the sharp pointed instrument provided, punch a hole in the cardboard 1 cm in from the edge at each one of your marks. It is now ready to be used as a compass.

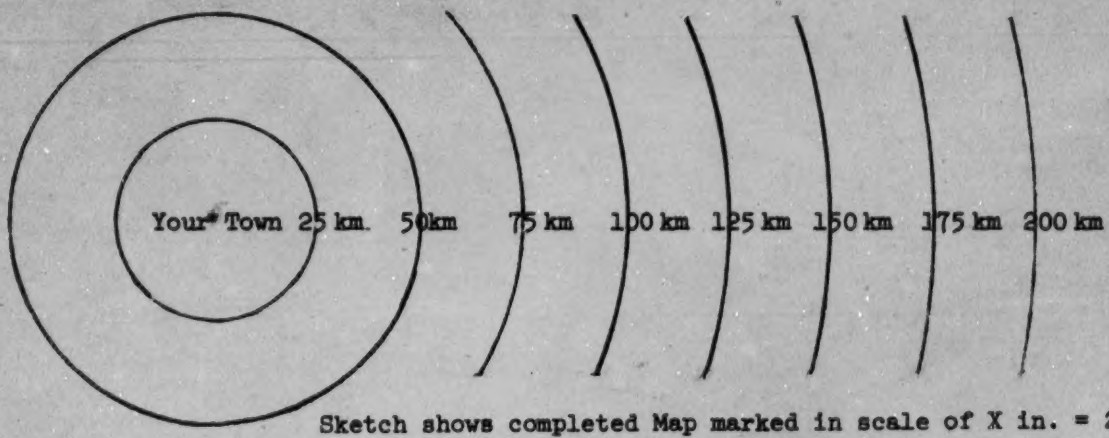
8. Place the sharp pointed instrument in point zero directly over the location of the town your school is in on the map.

---

[1]Bellipanni, L. J. and Flowers, John M., "Roadmaps and the Metric System," Science and Children, 11 (April, 1974), 16.

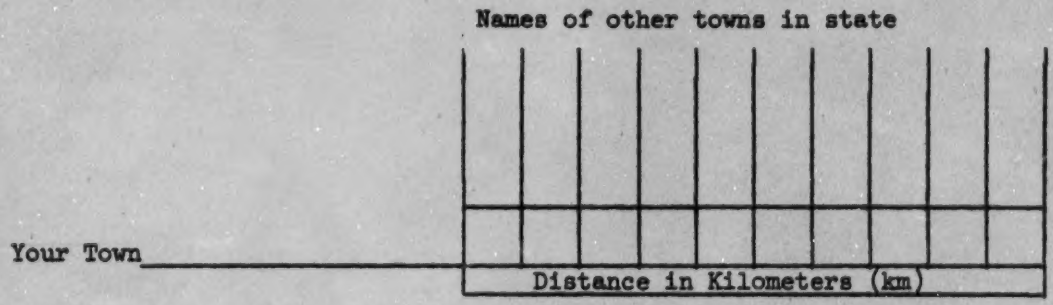
9. Place your pencil in the second hole and, holding the end of the ruler with one hand, make a complete circle about your point zero. Repeat for each of the holes.

10. Label each of the circles in kilometers and your map is ready to use.



Sketch shows completed Map marked in scale of X in. = 25 km

B. Using the scale on your map, complete the following chart:



C. Rules of the Road

To avoid speeding tickets it is necessary to remember that a kilometer is shorter than a mile. Actually 1 mile is equal to 1.6 kilometers. This means that our speed limits will be stated in terms of larger numbers. So, providing we are thinking in terms of kilometers, we will soon be driving 50 km/hr through town and 90 km/hr on the freeways.

Select four of the cities on your mileage chart and determine the driving time to each of these cities while driving at a speed of 90 km/hr (55 mi./hr.) and while driving at a speed of 50 km/hr (30 mi./hr.).

	City	Driving times 90 km/hr	50 km/hr
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____

"RULE OF THUMB" CONVERSIONS (YELLOW STATION)

A. Thinking Metric is the aim of this station. Because we already have learned to estimate many quantities in the customary measures, we should learn to convert our estimation habits to the metric system.

Memorizing conversion tables is the hard way to switch to the metric system. Only a few technical specialists will be required to use precise conversion factors to translate old measures to new ones. However, many consumers will feel more comfortable and be able to visualize relationships better, if they are familiar with a few "rule of thumb" conversions as a point of reference. The following table[1] shows some of the relationships between the metric and English units.

LENGTH:
A *millimeter* is about the thickness of a dime.
A *centimeter* is about the width of a common paper clip.
A *meter* is a little longer than a yard.
A *kilometer* is about six tenths of a mile.
Sixteen *kilometers* is about ten miles.

AREA:
A *hectare* is about the size of two football fields. (Two and a half acres)

MASS (WEIGHT):
Five *grams* is about the weight of a nickel.
Thirty *grams* is approximately one ounce.
A *kilogram* is 2.2 pounds.

LIQUID VOLUME
Five *milliliters* is about one teaspoon.
250 *milliliters* is approximately one cup.
A *liter* is a little larger than a quart.
Four *liters* is approximately one gallon.

TEMPERATURE
To find approximate degree Fahrenheit, double °C and add 30.
20°C is comfortable in the house.
37°C is body temperature.
100°C is boiling point of water.
0°C is freezing point of water.

---

[1]Chart from Teacher Resource Guide for Metric Education, Michigan Department of Education, Lansing, Michigan, p. 1.

B. Using the "Rule of Thumb" conversion table, answer the following questions.

1. The limit on overseas flights in the United States is 44 lbs. If you were in France boarding a flight to the United States, what would the baggage limit be in terms of kilograms?

   _____ kg

2. Tony has a temperature of 37°C. Should he stay home from school today?

   _____ Why?_____

3. I have only metric measures. My recipe calls for 1 cup of milk and 1 tsp. of vanilla. How many milliliters of milk and vanilla should I use?

   _____ mL milk _____ mL vanilla

4. I need to move a 3 foot square box into my backyard. The gate is 60 cm wide. Will it fit through the gate?

   _____ Why?_____

5. It is 20°C and Toby wants to go ice skating at an outdoor rink. Will he find a place to skate outdoors today?

   _____ Why?_____

6. Shawn has a mass of 132 pounds. What would be his approximate weight in kilograms?

   _____ kg

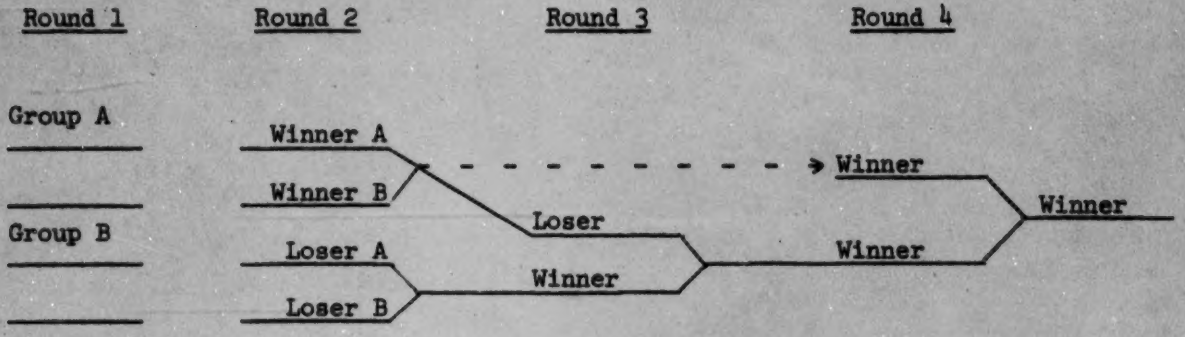
7. A room is 9 x 9 feet. I have a carpet which measures 3 meters long and 3 meters wide. Will I be able to use it in this room?

   _____ Why?_____

METRIC TIC TAC TOE (ORANGE STATION)

A. 1. Divide into groups of two.

2. Set up your playoffs using the following chart:



3. Each group should have a set of questions. Shuffle and deal the questions between the two people at each game.

4. Flip a coin and decide who will recieve the first question.

5. A correct answer results in player placing a marker of his/her chosen color in the desired spot. Incorrect answer results in loss of turn.

6. The winning person is determined as with game Tic-Tac-Toe, the first person to form a line horizontally, vertically or diagonally.

To win your group's tournament, you must have won at least three games. To be out of the tournament, you must have lost two games. It may be necessary to play a fifth round.

B. A prize will be awarded to the winner in each of the groups at the end of the module on metrics. Be sure to turn in the name of your group's winner to the teacher.

Proceed to the red station.

QUESTIONS FOR TIC TAC TOE GAME

Which room is the largest: 50 m x 45 m or 50 m x 1 km? A. 50 m x 1 km	What is wrong with this statement? 1 000 meters = 1 kilogram A. 1 000 meters = 1 kilometer 1 000 grams = 1 kilogram	How many centimeters is equal to 40 millimeters? A. 4 centimeters
What is the numerical value for milli? A. 0.001	What is the numerical value of centi? A. 0.01	If one kg of nails costs $1.60, what would 500 grams cost? A. $0.80
When we change our weight from pounds to kilograms, what happens to the numerical value? A. It decreases	When we change our measurements from inches to centimeters, what happens to the numerical values? A. They increase	When we change our speed limits from miles per hour, to kilometers per hour, what happens to the numerical values? A. They increase
Are metric abreviations followed by periods? A. No	What metric measure will be used to express a man's shirt size? A. Centimeters	What is the basic metric unit for volume? A. Liter
Approximately how much larger is a kilogram than a pound? A. 2 times	In what country did the metric system begin? A. France	A 1 lb. box of crackers weighs approximately how many grams? A. 500 g
Which direction does the decimal point move as we change from 1 liter to 1 000.0 ml? A. To the right	Joe has 4 jars of chemicals for his photograph developing room. Each jar contains 1 000 g. What is the total number of kg of chemicals he has? A. 4 kg	How many tiles are needed to cover a vestibule measuring 90 cm x 120 cm. The tiles are 30 cm x 30 cm. A. 12 tiles

QUESTIONS FOR TIC TAC TOE GAME

Which is larger, a meter or a yard? A. A meter	Will our money change when we have completed the switch to the metric system? A. No	The first men on the moon used which of the metric measures to record their walk? A. The meter
What number is the metric system based on? A. 10	Which is the largest -- 1 L of paint or 1 quart of paint? A. 1 liter	What metric measure will replace calories as a unit of energy? A. Joules
How many millimeters is equal to 1 centimeter? A. 10 millimeters	Which is larger, a kilometer or a mile? A. A mile	In metric terms, what would be a comfortable room temperature? A. 20-22°C
If you need to add oil to your car, what metric measure would you use? A. A liter	What will water do at 100°C? A. Boil	How would you write the metric symbol for 110 kilometers correctly? A. 110 km
What measurement system does 90% of the world use? A. Metric System or System International	Mrs. Jones wants to know how much carpet she should buy for her living room. What metric measure will she use to measure the room? A. A meter	Which would be more filling, a liter or a quart of pop? A. A liter of pop
What is the size of an Olympic swimming pool? A. 50 m x 25 m	How many liters of water does a cubic decimeter contain? A. 1 liter	What metric measure is used to size eyeglasses? A. A millimeter

QUESTIONS FOR TIC TAC TOE GAME

What is the mass of 1 mL of water? A. 1 gram	Do you buy light bulbs by killowatts or amperes? A. Kilowatts	SI metric means -- _____ _____ metric. A. System International
How much does 1 L of distilled water weigh? A. 1 kg	What does the metric prefix "kilo" mean? A. 1000 times	Will time change when we have completed our metric conversion? A. No
What metric measure will Tom use to measure chemicals for his chemistry set? A. A gram	What metric term will replace the mile in expressing great distances? A. Kilometer	You will be buying fabric by the _____. A. Meter
Using metric terms, what is normal body temperature? A. 37°C	What is the correct way to write the abreviation for millimeters? A. mm	Would you buy cheese by the liter or the gram? A. Gram
Which prefix indicates the smaller amount -- centi or milli? A. Milli	What would be a good beach temperature for swimming? A. 30°C to 40°C	Does a glass of milk equal approximately 1 liter or 250 mL? A. 250 mL
In metric terms, how will carpet be purchased? A. In square meters (m^2)	At what metric temperature does water freeze? A. 0°C	Would you buy flour by the gram or meter? A. Gram

QUESTIONS FOR TIC TAC TOE GAME

Which is the fastest, 50 mi./hr. or 50 km/hr? A. 50 mi./hr.	How many liters do four containers of 250 mL equal? A. 1 L	Approximately how much does a paper clip weigh? A. 1 gram
What metric term would you use to report your weight on an insurance form? A. Kilogram	Which prefix indicates the larger amount -- milli or kilo? A. Kilo	If one nickel weighs about 5 grams, how many nickels will it take to have the weight of 1 kg? A. 200 nickels

POST-TEST
THE METRIC SYSTEM

Name:_____

I. Multiple Choice: In the blank to the left of each statement, place the letter of the answer which best completes each statement.

_____1. One reason for changing to the metric system now, is that
a) we can assist the rest of the world in making the switch.
b) our allies will follow our example and switch also.
c) it is simpler and easier to use.
d) all of these.

_____2. A gram is about the weight of
a) an apple b) a pin c) a pineapple d) a large paper clip.

_____3. Water will freeze and boil at
a) 32°C and 212°C b) 0°C and 100°C c) 100°C and 200°C
d) 32°C and 100°C

_____4. Normal body temperature is about
a) 28°C b) 37°C c) 42°C d) 98°C

_____5. The standard of length in the metric system is the
a) mile b) yard c) meter d) kilometer

_____6. A liter of water weighs about
a) 1 gram b) 10 grams c) 100 grams d) 1 000 gm

_____7. On teaspoon full of cough syrup would be approximately
a) 0.5 mg b) 1 mL c) 5 mL d) 10 mL

_____8. The height of a man playing center on a typical high school basketball team is approximately
a) 6 m b) 240 m c) 78 cm d) 2 m

_____9. The approximate values for milli, centi, and kilo, respectively, are
a) 1 000, 100, 10 b) 10, 1 000, 100 c) 0.001, 0.01, 1 000
d) 1 000, 100, 0.001

____10. Mr. Knight wants to know how much tile he should buy for the entry way. He should measure the entry way using
a) liter b) meter c) gram d) kilometer

____11. Tom is weighing chemicals for his chemistry set. He is weighing them by the
a) liter b) meter c) gram d) milliliter

____12. The volume of a one-liter milk carton would be approximately
a) 1 000 mL b) 100 mL c) 10 mL d) 1 kg

____13. The correct abbreviation for three milliliters is
a) 3 ml b) 3 mLs c) 3mL d) 3 mL

____14. If the service station attendant added a can of oil to your car, it would probably be
a) 2 mL b) 200 mL c) 1 L d) 20 L

____15. The weight of an average size lady would be
a) 3 500 g b) 52 kg c) 25 kg d) 110 kg

____16. The temperature of the desert at midday could be
a) 40°C b) 60°C c) 90°C d) 100°C

____17. The length of a car is approximately
a) 5 m b) 15 mm c) 26 m d) 3 cm

____18. A good temperature to set your home thermostat at for comfortable living would be
a) 20°C b) 32°C c) 70°C d) 90°C

____20. What unit of measure would you use to find the correct ring size?
a) millimeter b) centimeter c) decimeter d) meter

II. Completion: Change each of the following metric units to the correct number of units indicated.

21. 1 kg = _____ g
22. 1 g = _____ mg
23. 1 m = _____ km
24. 1 m = _____ cm
25. 1 L = _____ mL
26. 4 000 m = _____ km
27. 1.27 kg = _____ g
28. 155 cm = _____ m
29. 475 mL = _____ L
30. 679 mm = _____ cm

III. The store where you work has just converted to the System International. The manager asked you to change the price tags on various items to their metric units. Change the underlined English unit to its metric unit of similar magnitude. Will the price on the item have to be <u>increased</u> or <u>decreased</u>? Give a reason for your answer.

example: 1 gal./$1.19	Metric Unit: liter	Affect On Price Per Unit: decreased	Reason: liter is smaller unit than a gallon
31. 1 qt. oil/59¢	_____	_____	_____
32. 1 yd. ribbon/89¢	_____	_____	_____
33. $1.29/yd.^{3}	_____	_____	_____
34. 1 oz./25¢	_____	_____	_____
35. 1 lb./$1.19	_____	_____	_____

SUPPLEMENTAL RESOURCES

PERIODICALS:

Grzesiak, Katherine A. "America and the Metric System: Present Perspectives," Elementary School Journal, 76, (January, 1976) pp. 195-200.

Oppert Judy. "The Home Economics Teacher and Metrics: Lessons 1-8," Illinois Teacher of Home Economics, XVIII, No. 2-5 (November - June, 1974-75).

Rusnock, Michael A. "On Your Mark, Get Set -- For a Metric Olympics," Teacher, 92 (May/June 1975) pp. 85-86. (An interesting activity)

Shumway, Richard J. and Sacks, Larry. "Don't Just Think Metric -- Live Metric," Arithmetic Teacher, 22 (February, 1975) pp. 103-110.

BOOKS:

Gilbert, Thomas F. and Gilbert, Marilyn B. Thinking Metric, John Wiley, Sons, 1973.

Hallamore, Elizabeth. Metric Book of Amusing Things to Do, Barrons Educational Series, Inc., 1974.

Maxey, Franklin. Metric Made Easy Book 2, The Instructional Fair, Inc., 1973.

Ryan, William T. and Vest, Paul Joe. Modern Metrics Made Easy, Clearvue, Inc.

Wiltsie, David H. Skills for Everyday Living. Motivation Development, Inc., Bishop, California 93514, 1976.

AUDIO VISUAL:

A Metric America. 6 color filmstrips and accompanying records or tape cassettes. Junior High through Adult. AIMS Instructional Media Services, Inc., P. O. Box 1010, Hollywood, Ca. 90028, 1973. $90 with cassettes, $78 with records.

A METRIC AMERICA. 16 mm color film, 16 minutes. Junior High through Adult. AIMS Instructional Media Services, Inc., P. O. Box 1010, Hollywood, Ca. 90028. $215.

SUPPLIES:

"Metric Trunk" (REMC) includes the following metric supplies: tape measures, thermometers, meter sticks, liquid measures, decimeter cube, interlocking centimeter cubes, balance scales and buckets, weights, bathroom scale.

"Decimeter Cube"
Order from: #DM10
A. Balla Company

or

To obtain a pattern for a decimeter cube see:
Michigan School Board Journal, Volume XXII, No. 7 (September, 1975)

Reprints of heavy paper pattern may be obtained in lots of ten for $2.00 postpaid from:
The Michigan School Board Journal
421 West Kalamazoo
Lansing, Michigan 48933

GAME:

Metre - Litre - Gram Game. A simple board game for two to ten players, ages 8 to adult. The game sharpens players' skills in metrics by asking such questions as: When buying cookies by the gram which is the best buy for $1? a. 500 g b. 250 g c. 1 kg. W. J. Hampton, Real-T-Facts, Warwick, N. Y. 10990. $6.30.

PAMPHLETS:

A Metric Reference for Consumers. American National Metric Council, 1625 Massachusetts Avenue, N. W., Washington, D. C. 20036. 30¢.

A Metric Workbook for Teachers of Consumer and Homemaking Education, Orange County Department of Education, September, 1975.

"Metric Exercises - Lively Activities on Length, Weight, Volume, and Temperature," National Science Teacher's Association, Washington, D. C. (ED085 251)

Realities of Metrication, International Brotherhood of Electrical Workers, 1125 15th Street, N. W., Washington, D. C. 20005, 1977. $2.00. (contains opposing arguments to metrics)

The Swing to Metric, Personnel Communications Department, Personnel Administration and Development Staff, General Motors, Detroit, Michigan .

Source of excellent materials (pamphlets, posters, charts, etc.) at no charge, write: Metric Commission, Box 4000, Ottawa, Ontario K1S 5G8.

APPENDIX

HOUSEHOLD CAPER

EXPLORE YOUR ENVIRONMENT

Look around your home to find items that are labeled or sized in metric measurements. As you find an item, fill in the chart below. If possible, bring the labels or items to class tomorrow. Don't forget to look in the kitchen, the work shop, the medicine cabinet, and the garage.

ITEM	CUSTOMARY MEASURE	METRIC MEASURE

Refer to page 11.

ARE YOU READY FOR METRICS? [1]

(ACTIVITY TEST)

On a piece of paper, please write down the correct answer. You will grade your own papers.

1. How many tablespoons are in one ounce? (2 tablespoons)
2. How many tablespoons are in one cup? (16 tablespoons)
3. How many ounces are there in a quart? (32 ounces)
4. How many quarts are there in a barrel? (105 quarts)
5. One bushel is equal to how many quarts? (32 quarts)
6. How many pounds are there in a ton? (2000 pounds)
7. How many ounces are there in a pound? (16 ounces)
8. How many feet are there in a mile? (5280 feet)
9. How many feet are in a rod? ($16\frac{1}{2}$ feet)
10. How many cubic feet are there in one cubic yard? (27 cubic feet)

Scoring:

9--10 correct: Congratulations! You really know the customary system, but you had better get ready for the metric system anyway. It's coming.

6-7-8 correct: Pretty Good! It may be difficult to adjust, but you have only about one-half of what you already know to forget!

0--5 correct: Lucky you! You have almost nothing to unlearn. You'll love the metric system. It's much simpler.

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[1] A Metric Workbook for Teachers of Consumer and Homemaking Education, Orange County Department of Education (Pre-Test developed by Kathleen Morris at California State University, Long Beach, California.

Refer to page 14.

EXAMPLE OF HOW METRICS WILL AFFECT THE HARDWARE BUSINESS

1. Cooking utensils (pots and pans, measuring devices)
2. Paints (size of cans and brushes)
3. Vehicles (Lawn mowers, snow blowers, bicycles)
4. Appliances (size of, temperature settings)
5. Garden tools (hose and nozzle sizes)
6. Sports equipment (guns, shells, helmets)
7. Building supplies (screws, nails, wire, wrenches, ropes)
8. Packaging (sizes)
9. Pricing (unit price)
10. Measuring
11. Transportation
12. Temperature
13. Mathematics

EXAMPLES OF ACTIVITIES INVOLVING METRIC MEASUREMENT WHICH WILL AFFECT THE CONSUMER

Linear Measurement: dry goods, lumber, surveys

Area Measurement: carpeting, wall paper, paint, lawn and garden supplies, taxes

Volume Measurement: lawn and garden supplies, construction supplies

Dry Measurement: produce, grocery items, cooking

Liquid Measurement: drugs, beverages, gasoline and oil, cooking

Time Measurement: parking lot, tool rental, travel time

Distance: car rentals, travel

Size Measurement: clothing, dry goods, building supplies

Canei, Robert A., "A Look at Metrics in Distributive Education," Ohio Distributive Education Materials Lab. Ohio State University. (ED 112 117, Jan-June 1976.)

Refer to page 16.

COMMON SAYINGS USING MEASUREMENTS

(ACTIVITY)

Change the underlined English unit of measurement in each statement to its metric unit.

1. Give him an <u>inch</u> and he'll take a <u>mile</u>. _____ _____
2. Don't hide your light under a <u>bushel</u> basket. _____
3. Penny wise and <u>pound</u> foolish. _____
4. There was a crooked man and he walked a crooked <u>mile</u>. _____
5. A miss is as good as a <u>mile</u>. _____
6. A <u>pint</u> is a <u>pound</u> the world around. _____
7. Six <u>foot</u> two, eyes of blue. _____
8. She talks a <u>mile</u> a minute. _____
9. I wouldn't touch him with a three <u>foot</u> pole. _____
10. An <u>ounce</u> of prevention is worth a <u>pound</u> of cure. _____
11. <u>Foot</u> long hot dogs. _____
12. A ten <u>gallon</u> hat. _____

<u>Answers</u>:

1. centimeter, kilometer
2. liter
3. kilogram
4. kilometer
5. kilometer
6. liter, kilogram
7. meter
8. kilometer
9. meter
10. gram, kilogram
11. meter
12. liter

Refer to page 16.

HANDYMAN HANK #1

This not-so-clever bird, Handyman Hank, has to buy the groceries and supplies for his nest. However, he does not know how to buy these items. Can you help him? Write the metric symbol beside each item Handyman Hank wants to buy. You will be given 1 point for each correct symbol and an additional point for each symbol written correctly.

1. Gasoline _____
2. Butter _____
3. Floor Wax _____
4. Lumber _____
5. Nails, screws _____
6. Glue _____
7. Carpet _____
8. Window Cleaner _____
9. Dish Soap _____
10. Paneling _____
11. Paint _____
12. Floor Tile _____
13. Meat _____
14. Milk _____
15. Lawn Fertilizer _____

Refer to page 18.

HANDYMAN HANK #2

This not-so-clever bird, Handyman Hank, is trying to learn to change from one unit to the next in the metric system. He seems to have difficulty trying to decide which way to move the decimal point and how many places to move it. Can you help him?

Hint:	kilo	whole	deci	centi	milli
	1 000	1	0.1	0.01	0.001

bigger ---------- smaller

1. 5 cm = _____ dm
2. 20 mg = _____ g
3. 500 g = _____ kg
4. 9 m = _____ dm
5. 500 mm = _____ m
6. 250 mL = _____ L
7. 750 mm = _____ cm
8. 300 mm = _____ dm
9. 3 m = _____ cm
10. 500 L = _____ mL
11. 7 000 m = _____ km
12. 4 kg = _____ g
13. 25 mL = _____ L
14. 70 mm = _____ dm
15. 2 cm = _____ mm

Handyman Hank has some more shopping to do. Help him decide which choice would give him the most (largest amount). Assume that the price has nothing to do with your choice. Circle your choice.

16. 10 kg or 2 500 g lawn fertilizer
17. 1 L or 4 mL milk
18. 125 mL or 250 mL glue
19. 1 m or 500 cm fabric
20. grass seed to cover an area 60 cm x 4 m or 0.9 m x 4 m
21. a 4 m or 80 dm long sports car
22. 2 500 mL or 2 L oil

Refer to page 21.

23. 2 L or 9 mL gas
24. 4 kg or 500 g dog food
25. 500 mL or 0.2 L window cleaner
26. 75 m^2 or 200 cm^2 carpet
27. 6 m or 200 cm long fencing
28. 1 kg or 750 g butter
29. 0.3 kg or 20 g nails
30. 5 m or 600 cm walkway

Refer to page 21.

FLUNKY FORECASTER[1]

(ADDITIONAL ACTIVITY)

You may wish to help the entire school learn to speak the metric language of temperature. On your school announcements, give the temperature to the nearest 5°C.

If you use a word to help describe that temperature, the students will find it easier to learn the unfamiliar units of temperature. For consistency, develop a table of the descriptive designations ranging from scorching hot to bitter cold. The descriptive words you use may vary depending on where you live and the time of the year. The chart[2] below is a suggestion of how you might begin to develop yours.

Temperature	Memory Aid	Reference Point
100°C		Boiling
40°C	Forty, Fiery	A hot, fiery, scorching day in summer in Arizona
30°C	Thirty, Thirsty	A thirsty, hot day in summer in New York
20°C		Room temperature
10°C	Ten, Tepid	A tepid day in autumn or in spring
0°C		Freezing
-20°C		A bitter cold day in winter
-40°C	Forty, Frigid	About as frigid as it ever gets in the U. S.

[1]Freeman, William K., "Think Metric About Weather," Arithmetic Teacher, 22 (May, 1975), 378-381.

[2]Gilbert, Thomas F. and Gilbert, Marilyn B., Thinking Metric, John Wiley and Sons (1973).

METRIC SCAVENGER HUNT[1]

(ADDITIONAL ACTIVITY)

If you have a club associated with your class, you may like to try a metric scavenger hunt on the school grounds. You may need to quickly review the metric units and their sizes especailly if there are students in the club who are not in your class. Use teams of 3 - 5 students and allow for a flexible time limit to permit slower teams to attempt most activities. Provide each group with a paper bag.

When the scavenger hunt is completed, have the students return to the classroom and measure the items they have found. You will need a balance scale, liquid measure, and metric sticks. Decide on the per cent of error you will allow for each item to still qualify.

The following are some suggestions of items you may have the students look for:

1. a piece of string 5 cm long
2. a twig 15 cm long
3. a piece of paper with an area of 1 cm^2
4. something which will hold 1 L
5. something weighing about 7 g
6. put together a metric system rhyme or joke
7. something longer than 1 m but shorter than 2 m
8. a substitute for a meter stick
9. something weighing about 500 g
10. a miscellaneous object identified metrically -- mass, volume, and dimensions

---

[1]Burton, Grace M. A Potpourri of Metric Activities, Elementary School Journal, 76 (January, 1976), 201-207.

ANSWER KEY

Pre-Test:

Part I

1. F
2. T
3. F
4. T
5. T
6. T
7. F
8. T
9. F
10. F

Part II

11. A
12. B
13. A
14. C
15. A
16. B
17. B

Part III

0.001 0.01 0.01 1 000

Post-Test:

Part I

1. C
2. D
3. B
4. B
5. C
6. D
7. C
8. D
9. C
10. B
11. C
12. A
13. D
14. C
15. B
16. A
17. A
18. A
19. C
20. A

Part II

21. 1 000 g
22. 1 000 mg
23. 0.001 km
24. 100 cm
25. 1 000 mL
26. 4 km
27. 1270 g
28. 1.55 m
29. 0.475 L
30. 67.9

Part III

			Reason?
31.	liter	increased	A liter is slightly larger than a quart.
32.	meter	increased	A meter is larger than a yard.
33.	meter	increased	A square meter is larger than a square yard.
34.	gram	decreased	A gram is smaller than an ounce.
35.	kilogram	increased	A kilogram is larger than a pound.

ANSWER KEY

HANDYMAN HANK

Handyman Hank #1

1. liter
2. kilogram
3. liter
4. meter
5. kilogram
6. gram
7. square meters
8. liter
9. gram
10. meter
11. liter
12. square meters
13. kilogram
14. liter
15. kilogram

Handyman Hank #2

1. 0.5 dm
2. 0.02 g
3. 0.5 kg
4. 90 dm
5. 0.5 m
6. 0.25 L
7. 75 cm
8. 3 dm
9. 300 cm
10. 500 000 mL
11. 7 km
12. 4 000 g
13. 0.025 L
14. 0.7 dm
15. 20 m
16. 10 kg
17. 1 L
18. 250 mL
19. 500 cm
20. 0.9 m x 4 m
21. 80 dm
22. 2 500 mL
23. 2 L
24. 4 kg
25. 500 mL
26. 75 m^2
27. 6 m
28. 1 kg
29. 0.3 kg
30. 600 cm

ANSWER KEY

LEARNING STATIONS

Mass (Red Station):

A. 1. 1 000 g 2. 0.01 g 3. 0.001 g
C. Determine the actual weight of the items you use.
D. If a scale is not available, you may wish to provide the students with the actual weights.
E. A stack of nickels worth $20.00 weighs 2 kg.
F. Determine the weight of your unknown.

Temperature (Blue Station):

A. 1. 100°C 2. 0°C cold, could snow
3. -10°C (approximately). The ice melted. To keep the snow from freezing.
4. 20-22°C Spring like. Long sleeve shirt weather. 5. 37°C hot

C. 1. 37°C 2. 0°C 3. 100°C 4. 20-22°C
5. -10°C (approximately)

Personal Measurements (Green Station):

1. Centimeters will be used most commonly.
2. A stack of pennies worth $10.00 is 166.66 cm tall.
3. The belt size is the same as the waist measurement.
5. You may wish to provide the students with the room dimensions.
7. If you are using an 8.5 x 11 piece of paper the width is 21.5 cm.

Length (Turquoise Station):

B. One meter is longer by approximately 3 inches.
100 cm = 1 m
C. 1. slightly larger than 2 m 2. one-half or 100 cm
D. Determine the actual measurements.
E. Determine the length of the unknown.
F. 1. 4 m x 3 m 2. 12 m^2 3. 15 tiles

"Rule of Thumb" Conversions (Yellow Station):

B. 1. 20 kg 2. No, 37°C is normal body temperature
3. 250 mL milk and 5 mL vanilla
4. No, a three foot square box measures 100 cm x 100 cm.
5. No, 20°C is room temperature.

TRANSPARENCY MASTERS

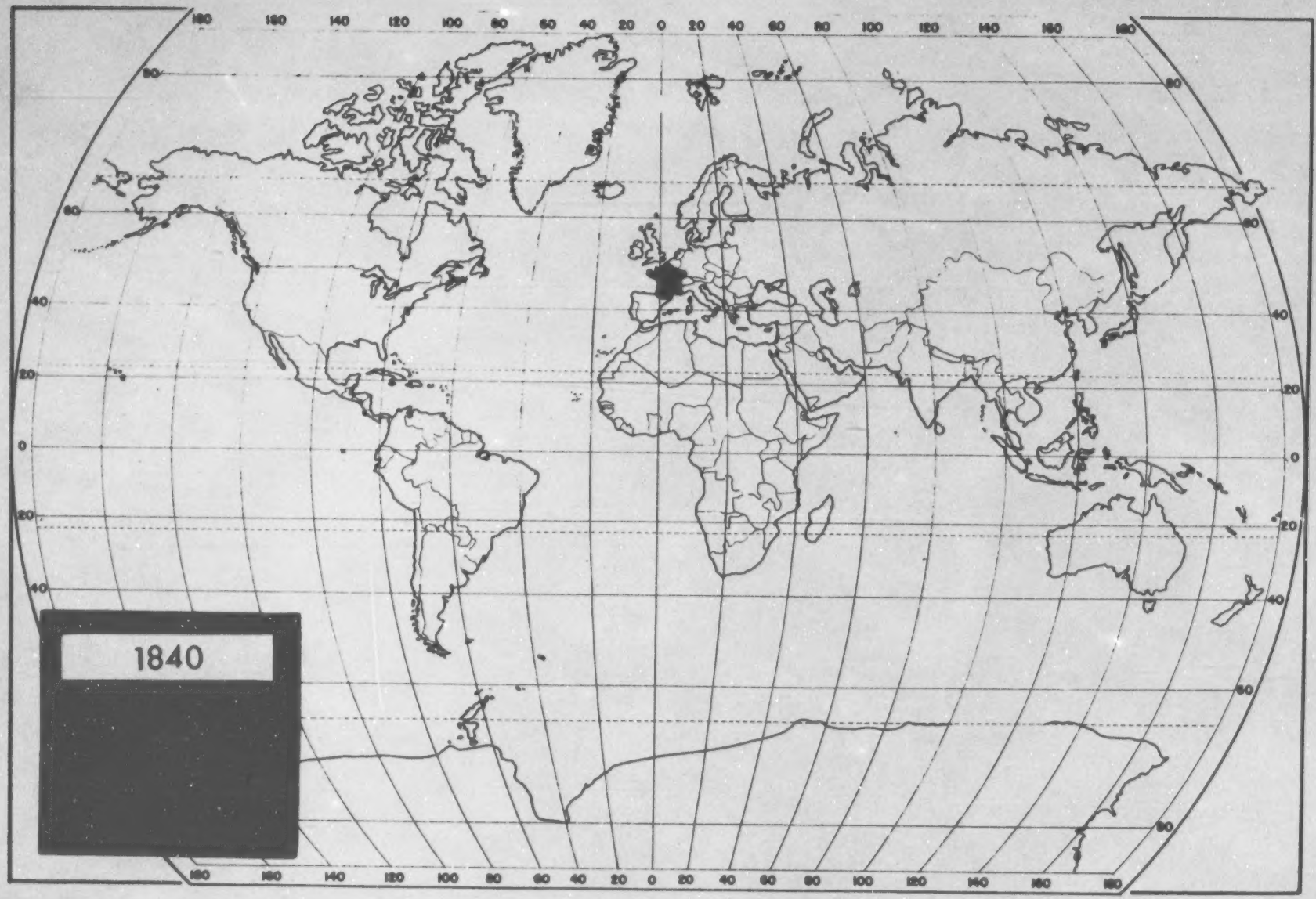
ACKNOWLEDGEMENTS

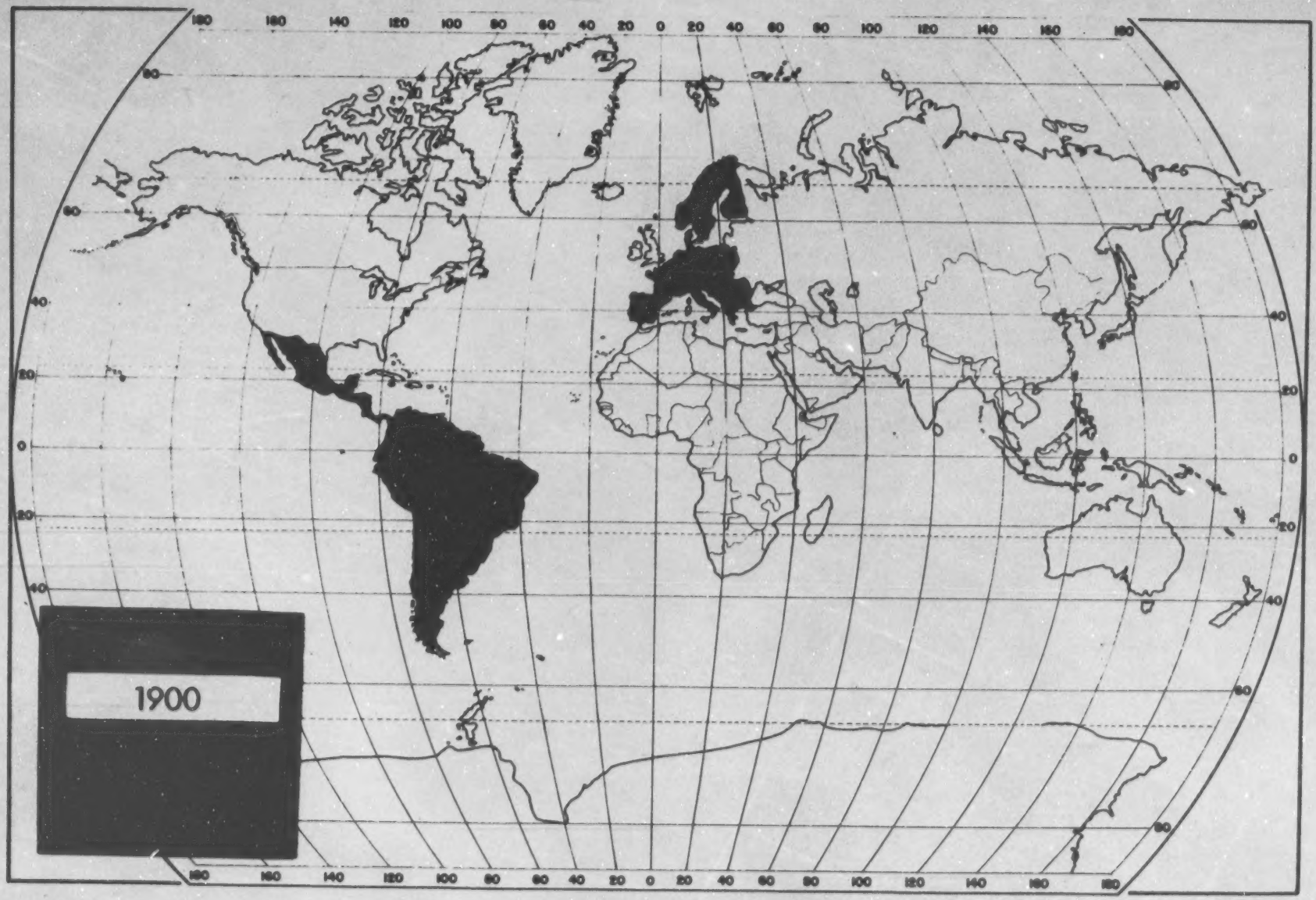
Center for Metric Education, Western Michigan University, USOE Sponsored Project No. V257006, Grant No. 0 EG-0-72-1868, pp. 73, 79, 81, 93.

A Metric Workbook for Teachers of Consumer and Homemaking Education, Orange County Department of Education, September, 1975, pp. 75-77, 86-87, 88-91, 94.

Developed by author, pp. 69-74, 78, 86, 92.

Teacher Resource Guide for Metric Education, Michigan Department of Education, Lansing, Michigan, pp. 80, 82, 83-85.


1840



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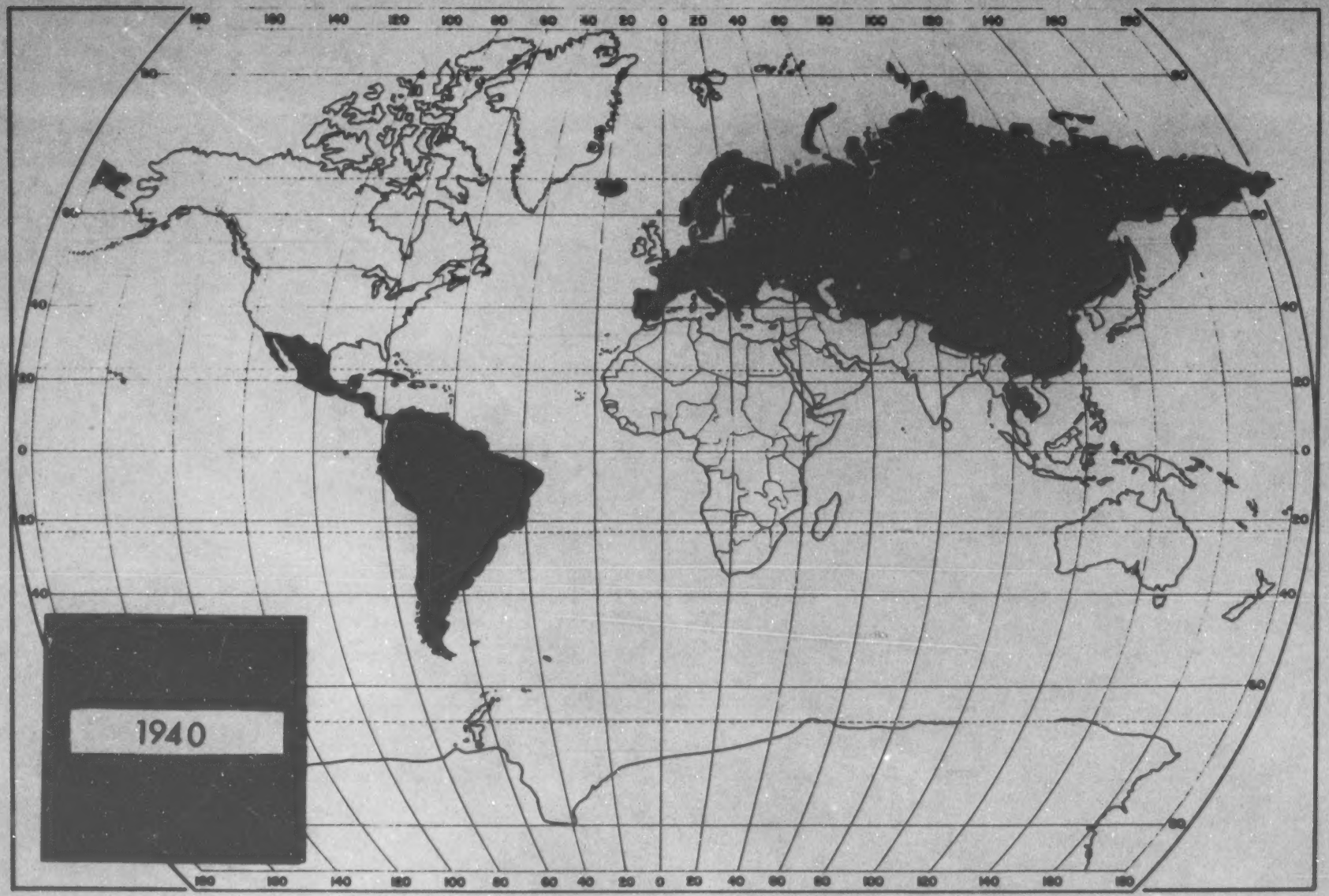
73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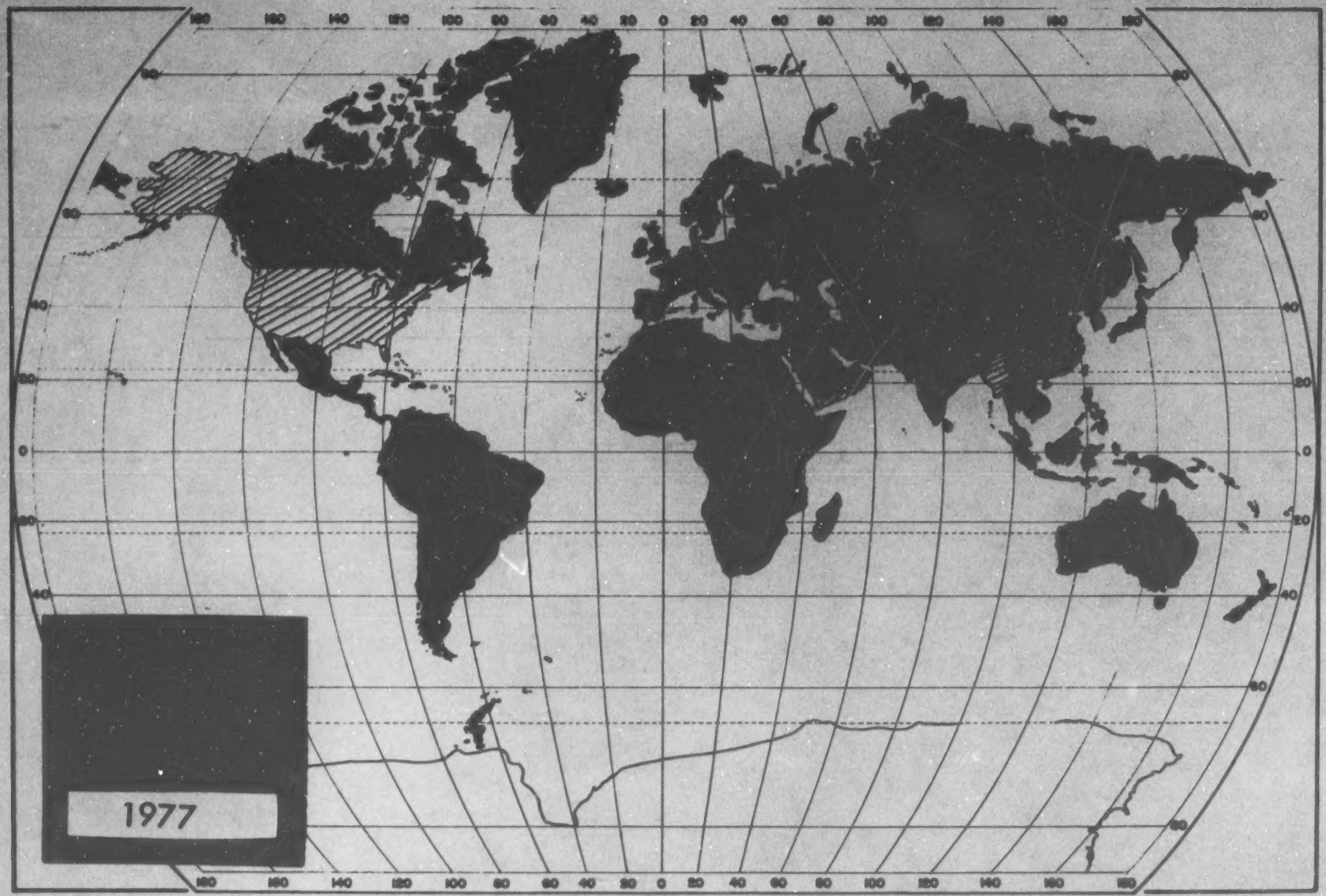

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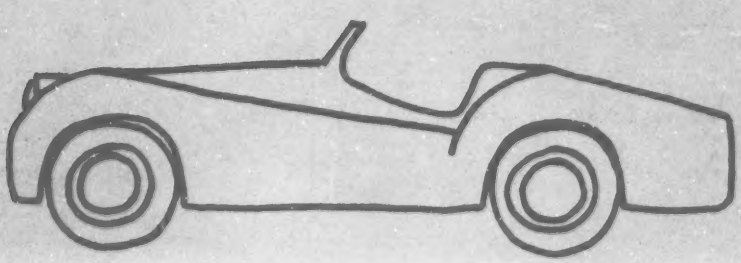
77

70



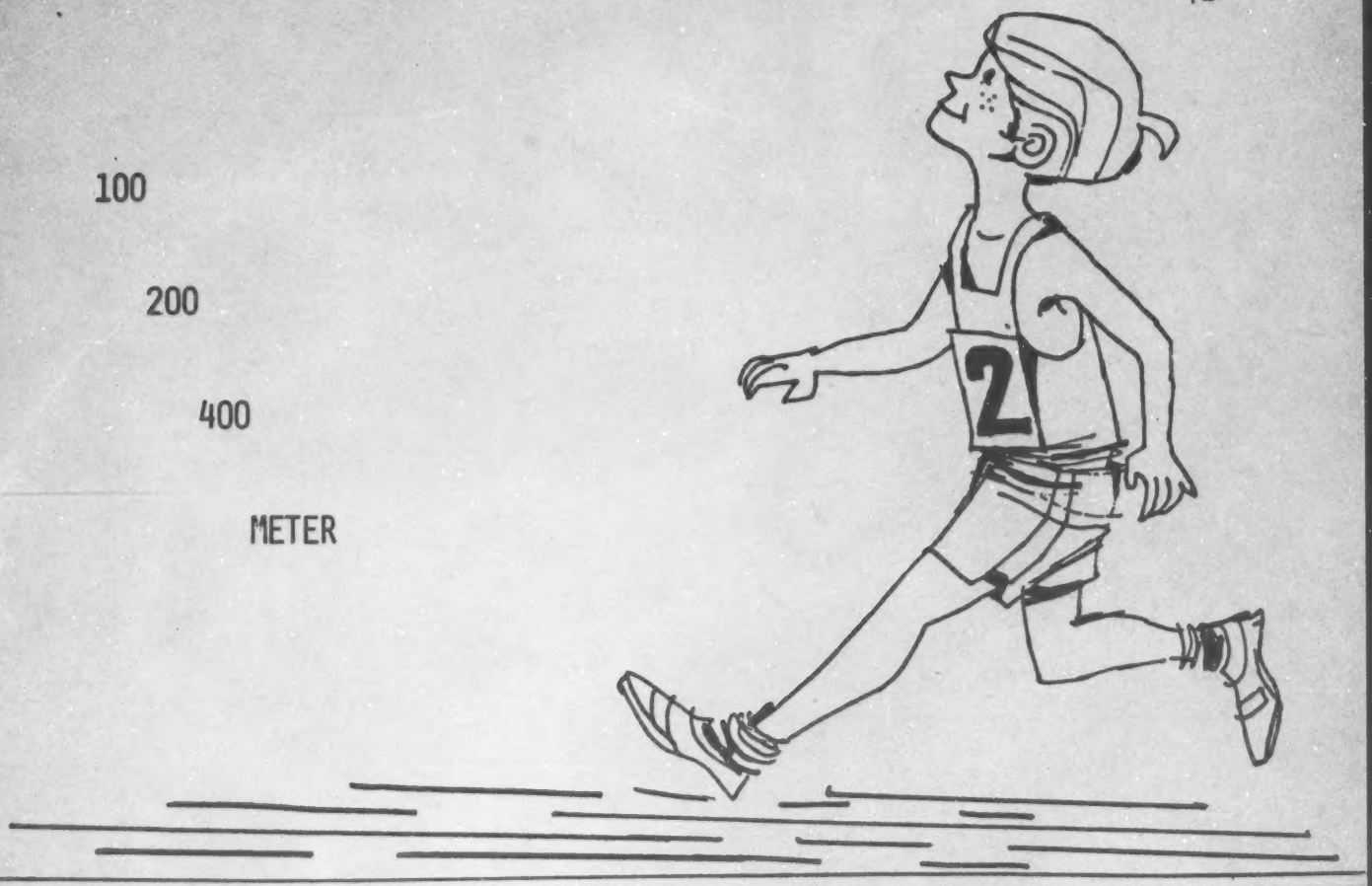
1 km
km/h
90
SPEED
LIMIT
TUNA
7oz. 1969

100

200

400

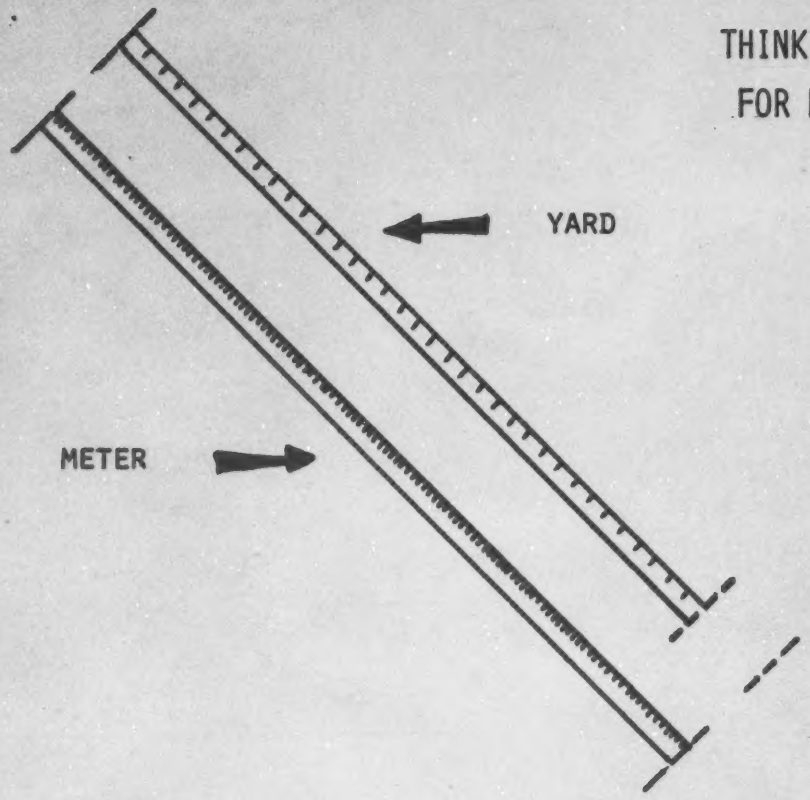
METER



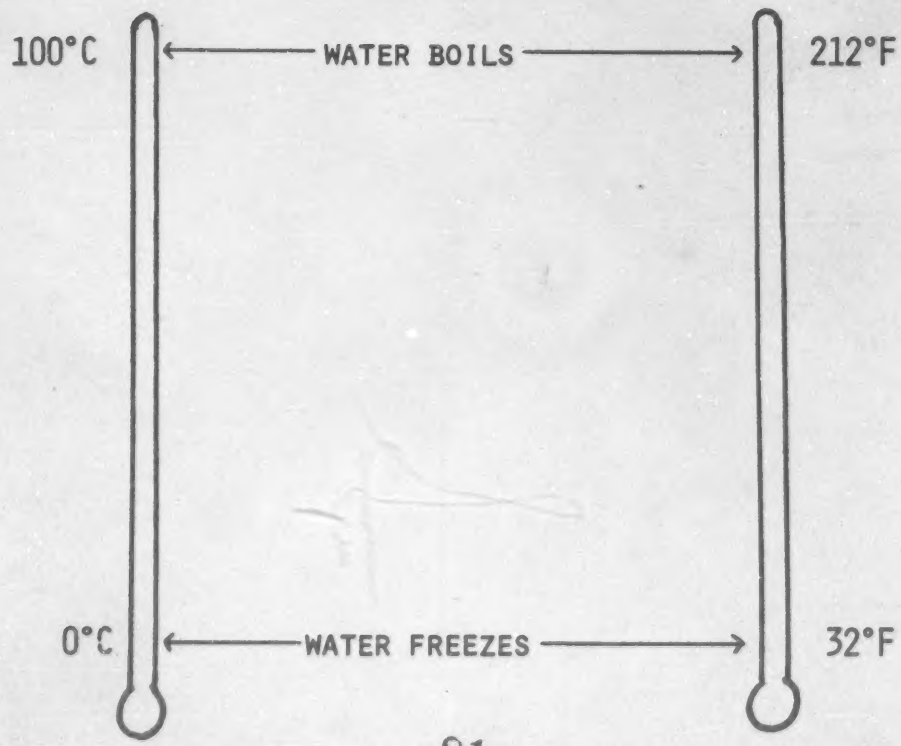
100 METER SWIM EVENT

OLYMPIC POOL 50 M X 25 M

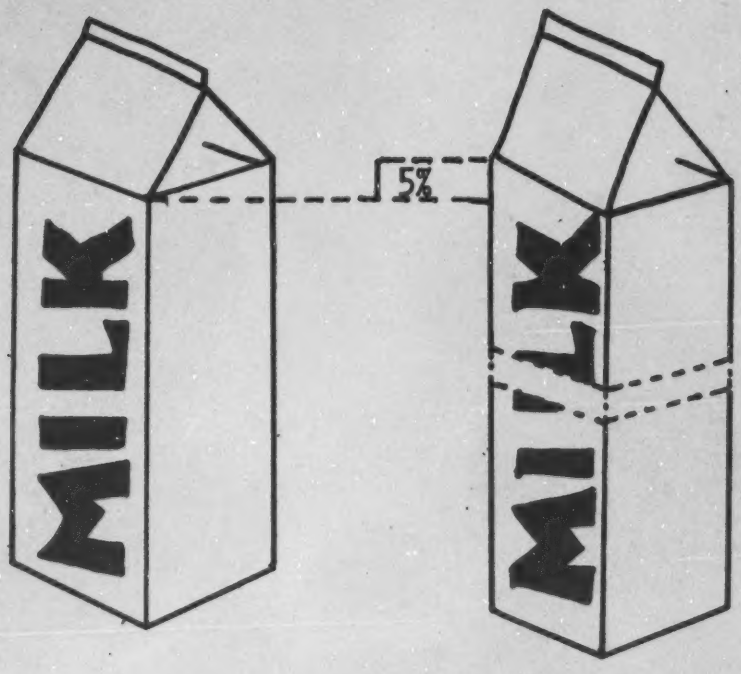
THINK METRIC
FOR LENGTH



THINK CELSIUS
FOR TEMPERATURE

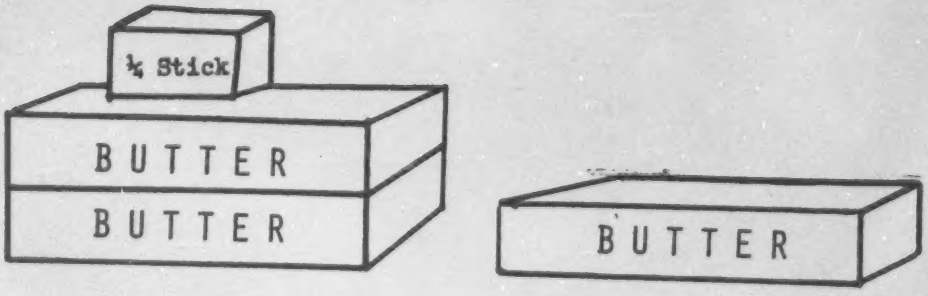


THINK LITER
FOR VOLUME



QUART LITER

THINK KILOGRAM
FOR MASS



ONE KILOGRAM OF BUTTER ONE POUND OF BUTTER

PRICE COMPARISONS

1. 1 KG CAN OF COFFEE SELLS FOR $2.25. WHAT DO SMALLER AMOUNTS SELL FOR?

   1 000 GM (1 KG) = $2.25

   100 GM (0.1 KG) = $0.225 OR 22.5¢

   10 GM (0.01 KG) = $0.0225 OR 2.25¢

   WHAT WILL A 500 GM CAN OF COFFEE COST?

2. 1 KG BAG OF FLOUR SELLS FOR $0.44. WHAT DO SMALLER AMOUNTS SELL FOR?

   1 000 GM (1 KG) = $0.44

   100 GM (0.1 KG) = $0.044 OR 4.4¢

   10 GM (0.01 KG) = $0.0044 OR .4¢

   WHAT WILL A 1 600 G BAG OF FLOUR COST?

3. 1 KG JAR OF PEANUT BUTTER SELLS FOR $2.00. WHAT DOES THE 900 G SIZE COST?

   100 GM COST _____

   900 GM X $\frac{\text{COST}}{100\ \text{G}}$ = _____

   1 POUND JAR OF PEANUT BUTTER SELLS FOR $0.90. WHAT DOES A 15 OZ. JAR SELL FOR?

   1 LB. = _____ OZ.

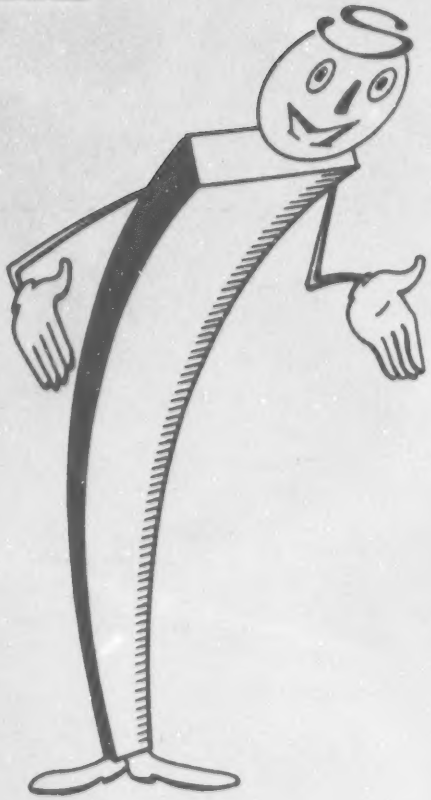
   1 OZ. COSTS _____

   15 OZ. X $\frac{\text{COST}}{1\ \text{OZ.}}$ = _____

   DID YOU FIND IT EASIER TO COMPARE THE COSTS USING THE METRIC OR ENGLISH UNITS? WHY?

Refer to page 14.

THREE MEASUREMENTS *to* REMEMBER



THE METER

is a little longer than a yard — — 39.37 inches.

THE LITER

is a little larger than a quart — about 6%

THE KILOGRAM

is a little more than twice the pound — 2.2 pounds

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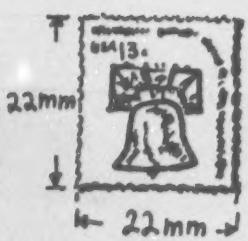
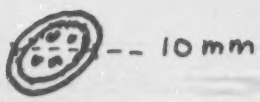
GRANT NO. O EG-0-73-1868

length

Distances between towns are measured in kilometers

kilometer	1 km = 1000 m
meter	100 cm
centimeter	10 mm
millimeter	1 mm





- small objects are measured in millimeters - mm.

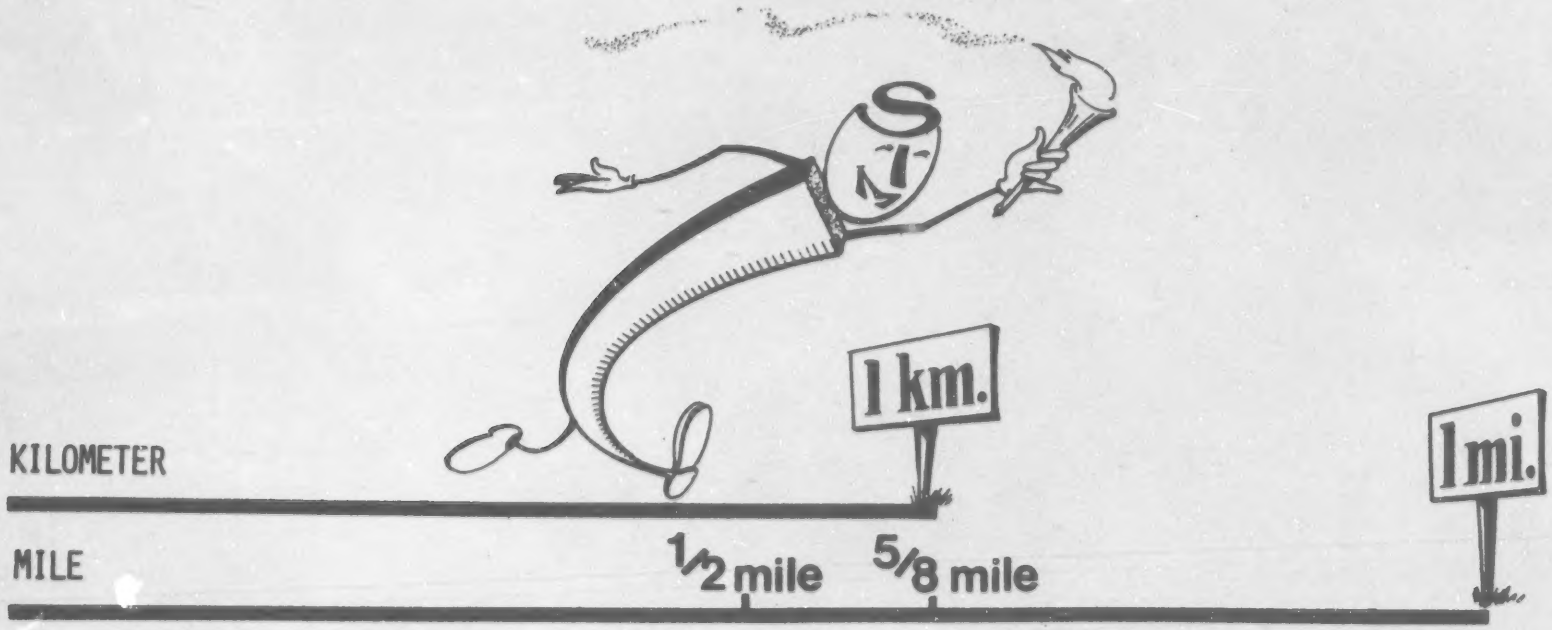
- skis are measured in centimeters - cm.

A KILOMETER

-is used for long distances.

1 000 METERS EQUAL ONE KILOMETER (KM).

A KILOMETER IS ABOUT 5/8 OF A MILE.



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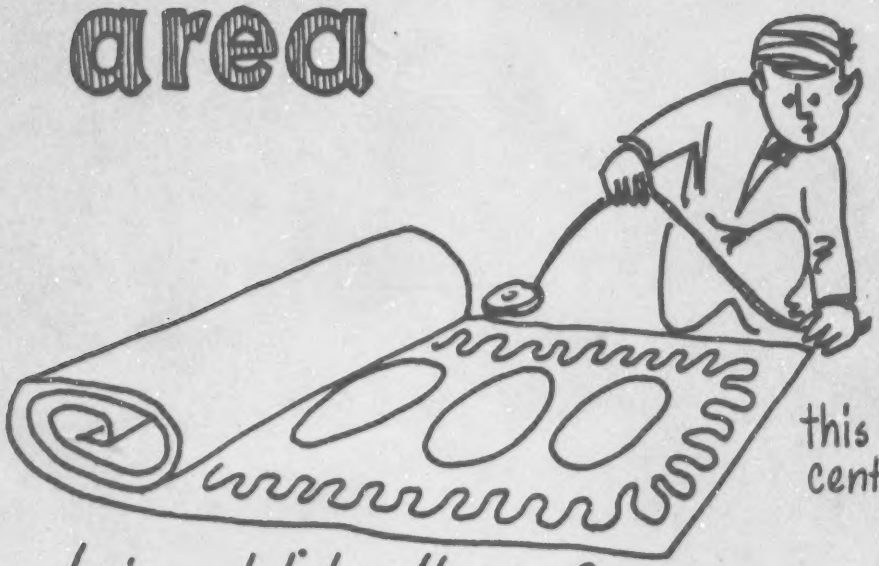
area



= cm^2

this is a square centimeter

Carpet is sold by the m^2

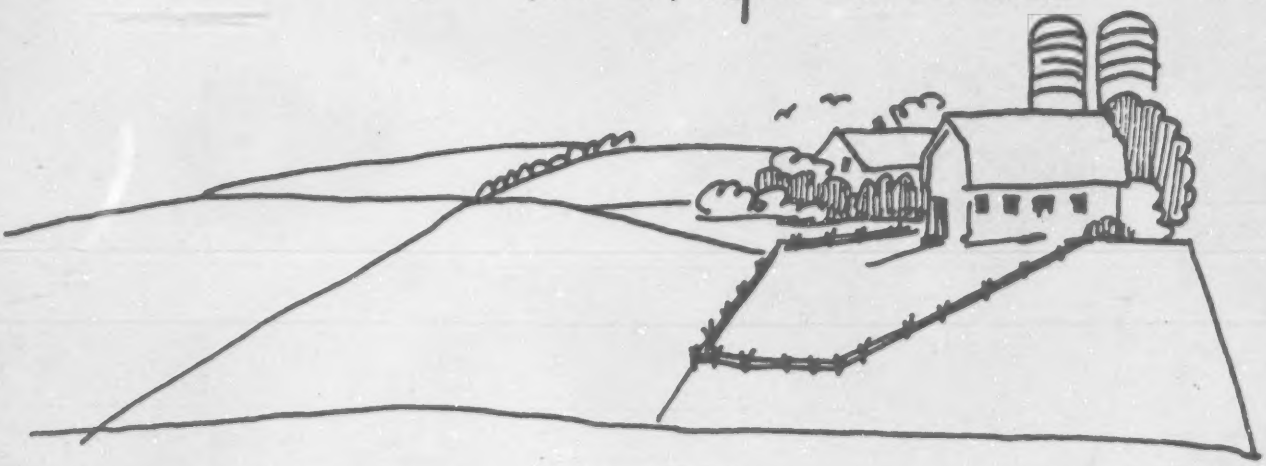
0.0001 ha = 1 m^2

10 000 cm^2 = 1 m^2

10 000 m^2 = 1 ha

0.000 1 m^2 = cm^2

1 m^2 = 1 square meter

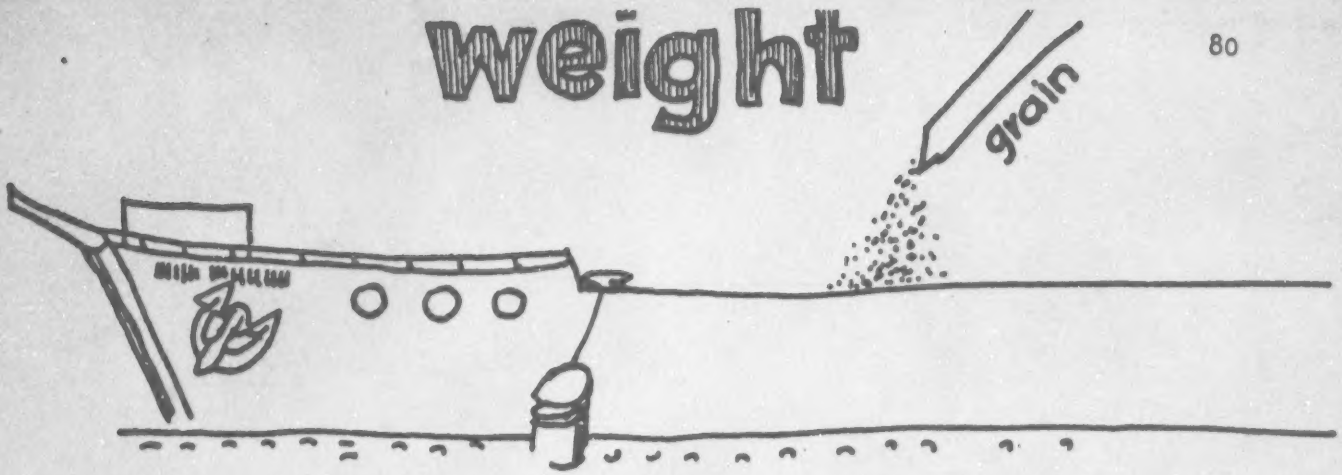


1 ha (hectare) is a little smaller than 2 football fields

Land is measured in hectares.

weight

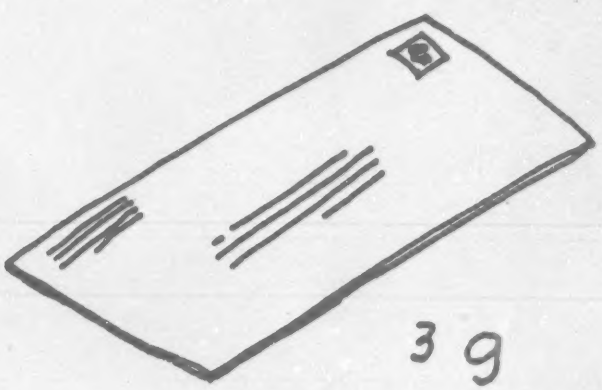
80



Ship loads of grain are measured in metric tons (t)

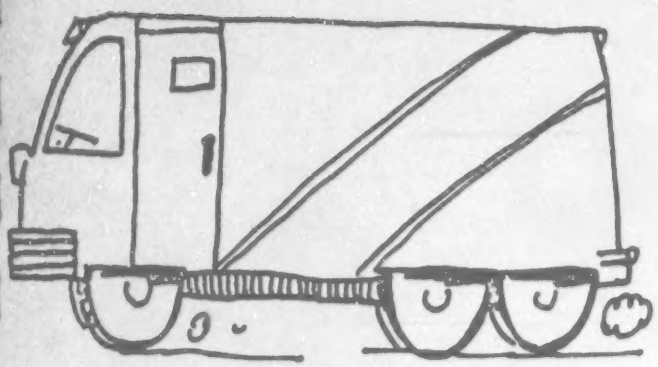
metric ton	(t)	1 t = 1000 kg
kilogram	(kg)	1 kg = 1000 g
gram	(g)	

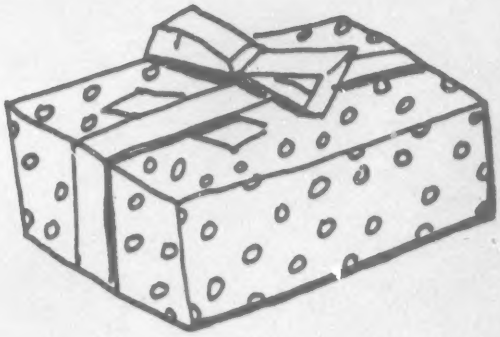
a person's weight is measured in kilograms



a letter is weighed in grams

volume





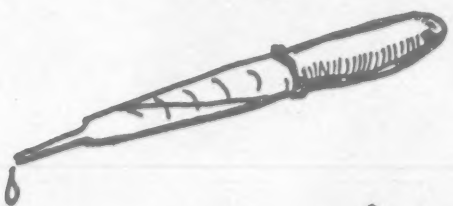
measure truck capacity in-$\underline{m^3}$

how many-$\underline{cm^3}$?

cubic meter . . . . . m^3
cubic centimeter 1 000 000 $cm^3 = 1 m^3$

liquid capacity

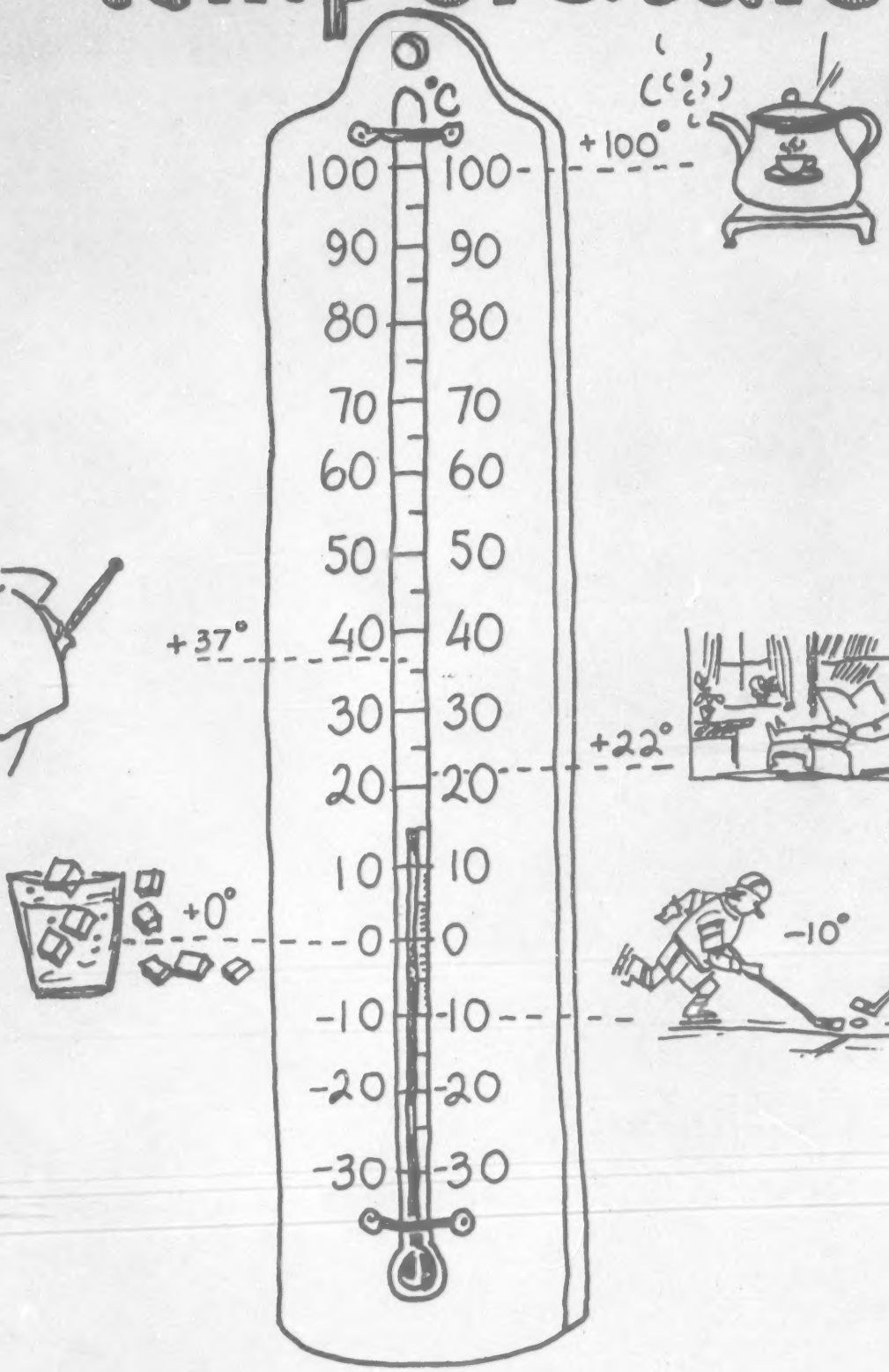
4 **L**

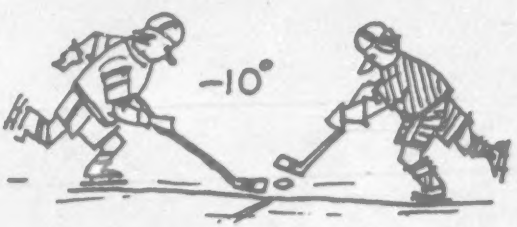


0.05 m**L**

liter (**L**) . . . . . **L**
milliliter 1 000 m**L** = 1 **L**

temperature





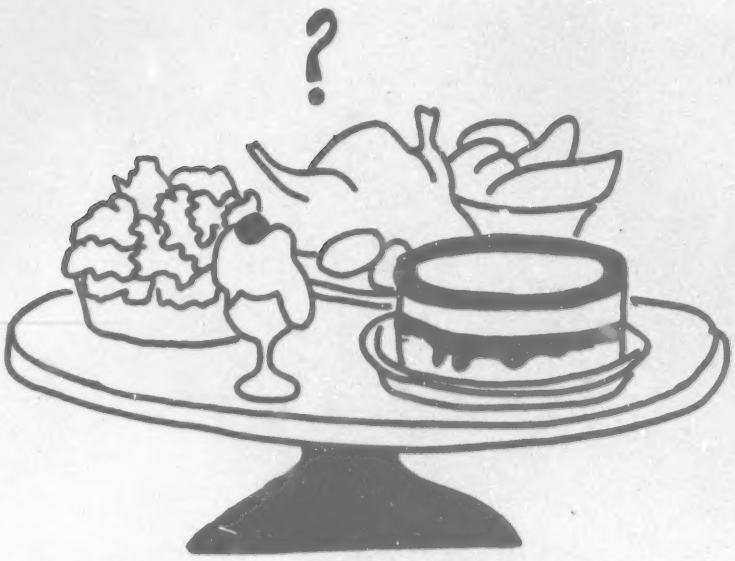
THINK JOULES FOR ENERGY

METRIC

DIET

4 000

JOULES



A DIET WITH A CALORIC VALUE OF 2,000 IS APPROXIMATELY EQUAL TO A DIET WITH AN ENERGY VALUE OF 8 000 KILOJOULES.

RATIO: 1:4 APPROXIMATELY

1:4.2 ACTUALITY

A

AMPERE

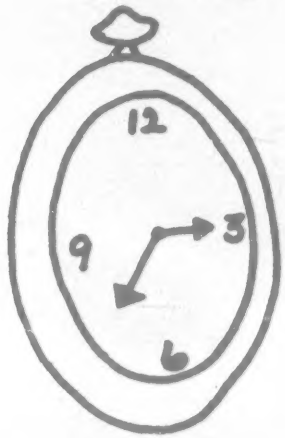
(Electric Current)

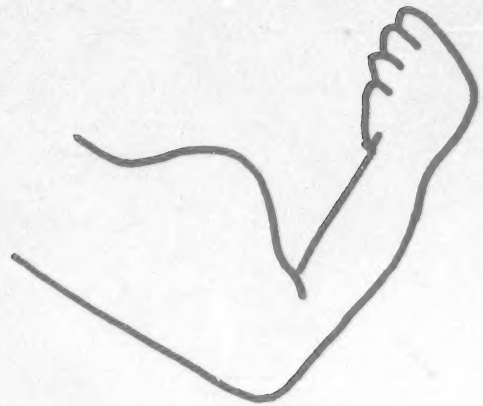
94

S

SECOND

(Time)





WATT

(Power)

W

95

NO: ~~14 CM~~

YES: 14 cm

THE SYMBOLS SHOULD BE IN LOWER CASE FOR THOSE DESIGNATED.

(HOWEVER, YES TO: C FOR CELCIUS AND L FOR LITER)

NO: ~~14 CMS~~

YES: 14 cm

NEVER USE AN "S" AFTER A SYMBOL.

NO: ~~14 cm.~~

YES: 14 cm

USE NO PERIODS AFTER SYMBOLS AND ALWAYS LEAVE A SPACE BETWEEN THE NUMBER AND THE METRIC SYMBOL.

NO: ~~14 degrees C~~

YES: 14 degrees Celsius

OR

14°C

TEMPERATURES ARE EITHER WRITTEN AS DEGREES CELSIUS OR °C, NOT DEGREES C.

NO: ~~.14 cm~~

YES: 0.14 cm

FOR A DECIMAL FRACTION LESS THAN ONE, ALWAYS PLACE A ZERO BEFORE THE DECIMAL.

NO: ~~14,000 km~~

YES: 14 000 km

COMMAS SHOULD BE OMITTED IN FIGURES REPRESENTING LARGE AMOUNTS.

NO: ~~1 m 14 cm~~

YES: 114 cm

AVOID MIXING UNITS

THE METRIC SYSTEM

1	2	3	4	5	6	7
DECIMAL VALUE	WORD EQUIVALENT	MONETARY EQUIVALENT	METRIC PREFIX	METRIC LENGTH	METRIC VOLUME	METRIC WEIGHT
0.001	THOUSANDTH	$0.001 MILL	MILLI	MILLIMETER (MM)	MILLILITER (mL)	MILLIGRAM (MG)
0.01	HUNDREDTH	$0.01 CENT	CENTI	CENTIMETER (CM)	CENTILITER*	CENTIGRAM (CG)
0.1	TENTH	$0.10 DIME	DECI	DECIMETER (DM)	DECILITER*	DECIGRAM (DG)
1.0	WHOLE	$1.00 DOLLAR		METER (M)	LITER (L)	GRAM (G)
1 000.0	THOUSAND	$1 000.00 GRAND	KILO	KILOMETER (KM)	KILOLITER*	KILOGRAM (KG)

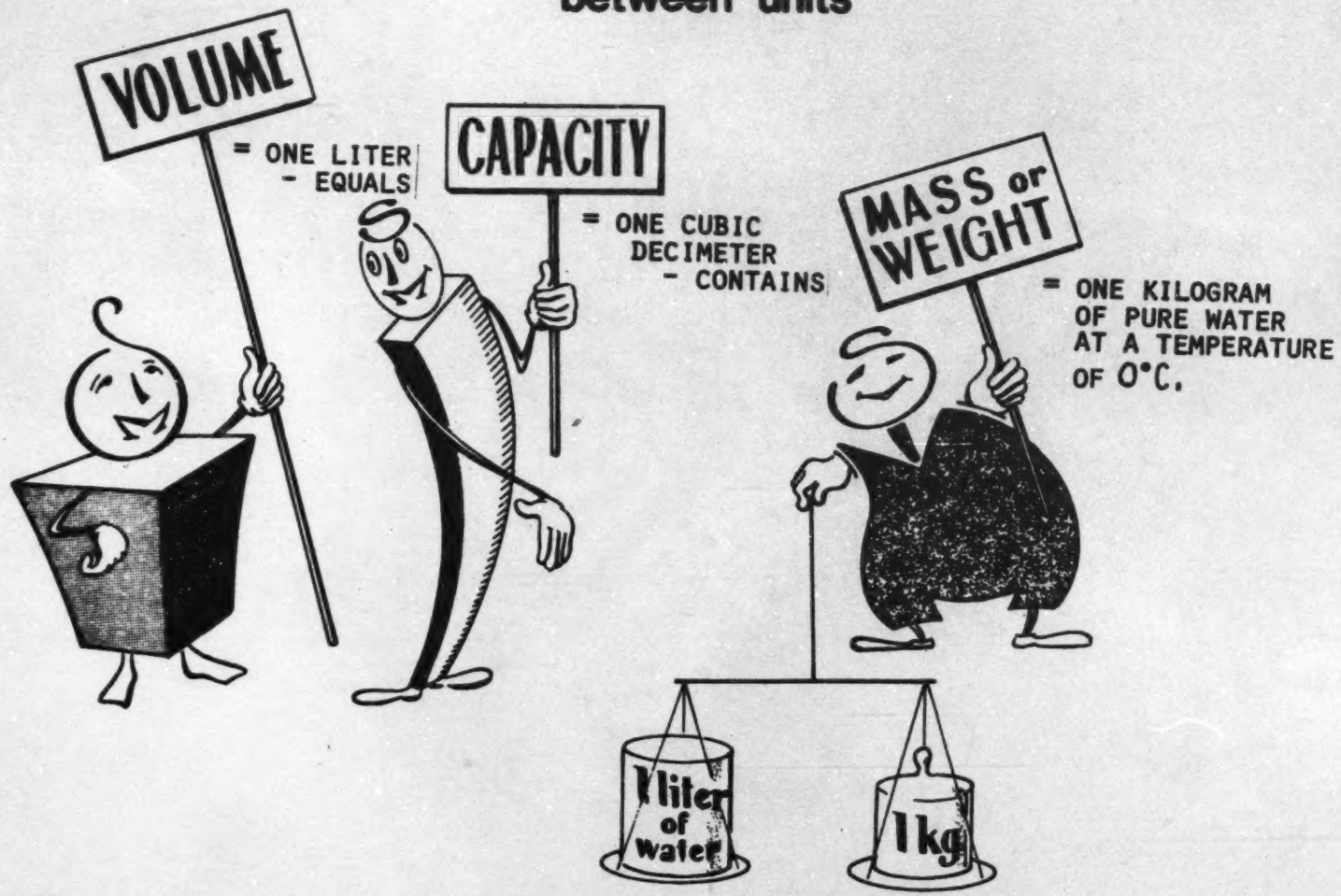
NOTE: AS YOU <u>DIVIDE</u> THE WHOLE AND MAKE IT SMALLER THE DECIMAL MOVES TO THE <u>LEFT</u>.

AS YOU <u>MULTIPLY</u> THE WHOLE AND MAKE IT LARGER THE DECIMAL MOVES TO THE <u>RIGHT</u>.

* NOT COMMONLY USED.

768

In the metric system there is a definite relationship between units



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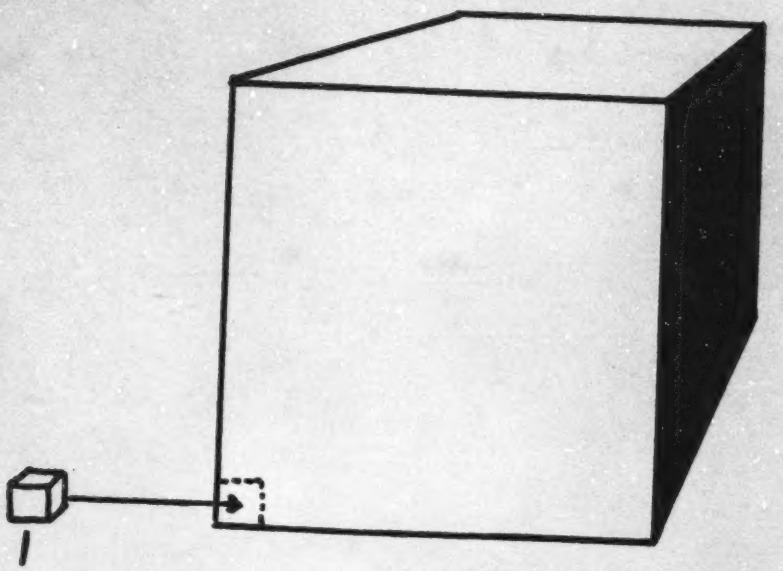
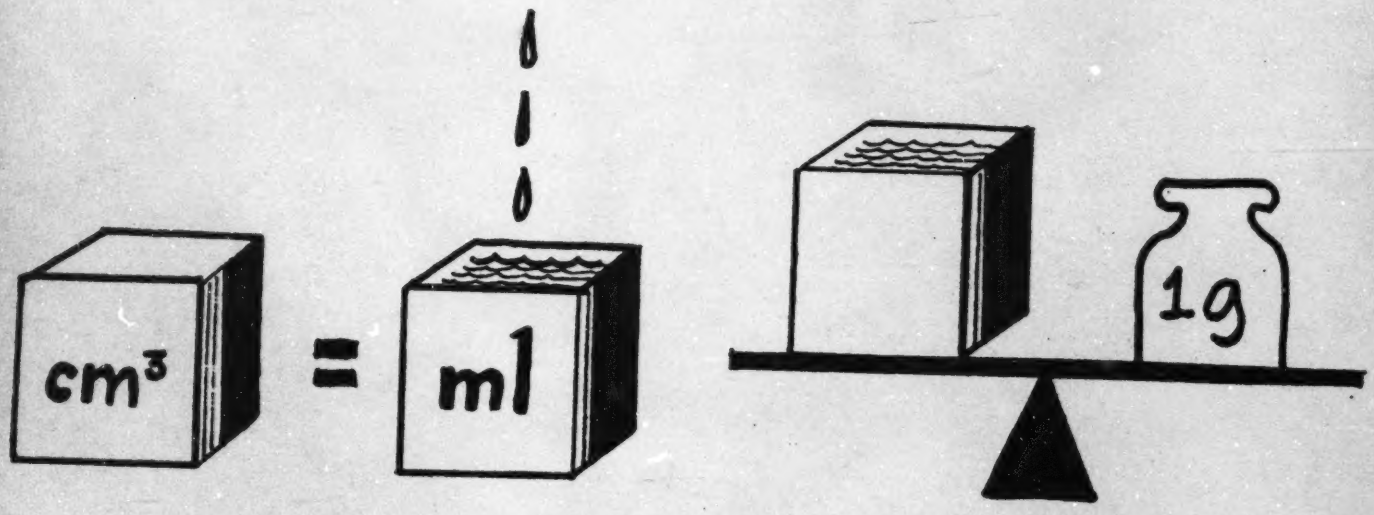


(1 CUBIC CENTIMETER) 1 CUBIC DECIMETER = 1 LITER AND WHEN FILLED WITH WATER WEIGHS 1 KILOGRAM



1 CUBIC CENTIMETER = 1 MILLILITER = 1 GRAM OF WATER

THE LITER RED SCHOOL HOUSE

BESTOWS THE

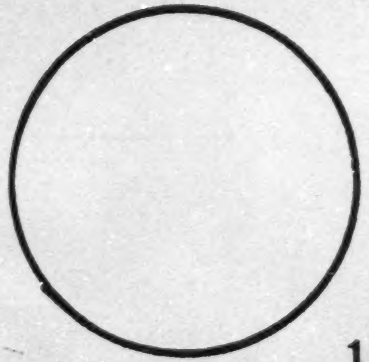
_____

AWARD
UPON

_____

IN THE ORDER OF THE METRIC MASTER

As a master of metric measurement you are entitled to use meters, liters, and kilograms for the rest of your life.



105

_____
Teacher's Signature

106